Draft

Wind River Subbasin Summary

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Prepared for the
Northwest Power Planning Council

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Subbasin Description

General Location

The Wind River Subbasin, located in southwestern Washington, originates in McClellan Meadows in the western Cascades on the Gifford Pinchot National Forest (Wind River Ranger District) and enters Bonneville Reservoir at River Mile (RM) 154.5 near Carson, Washington (Figure 1).

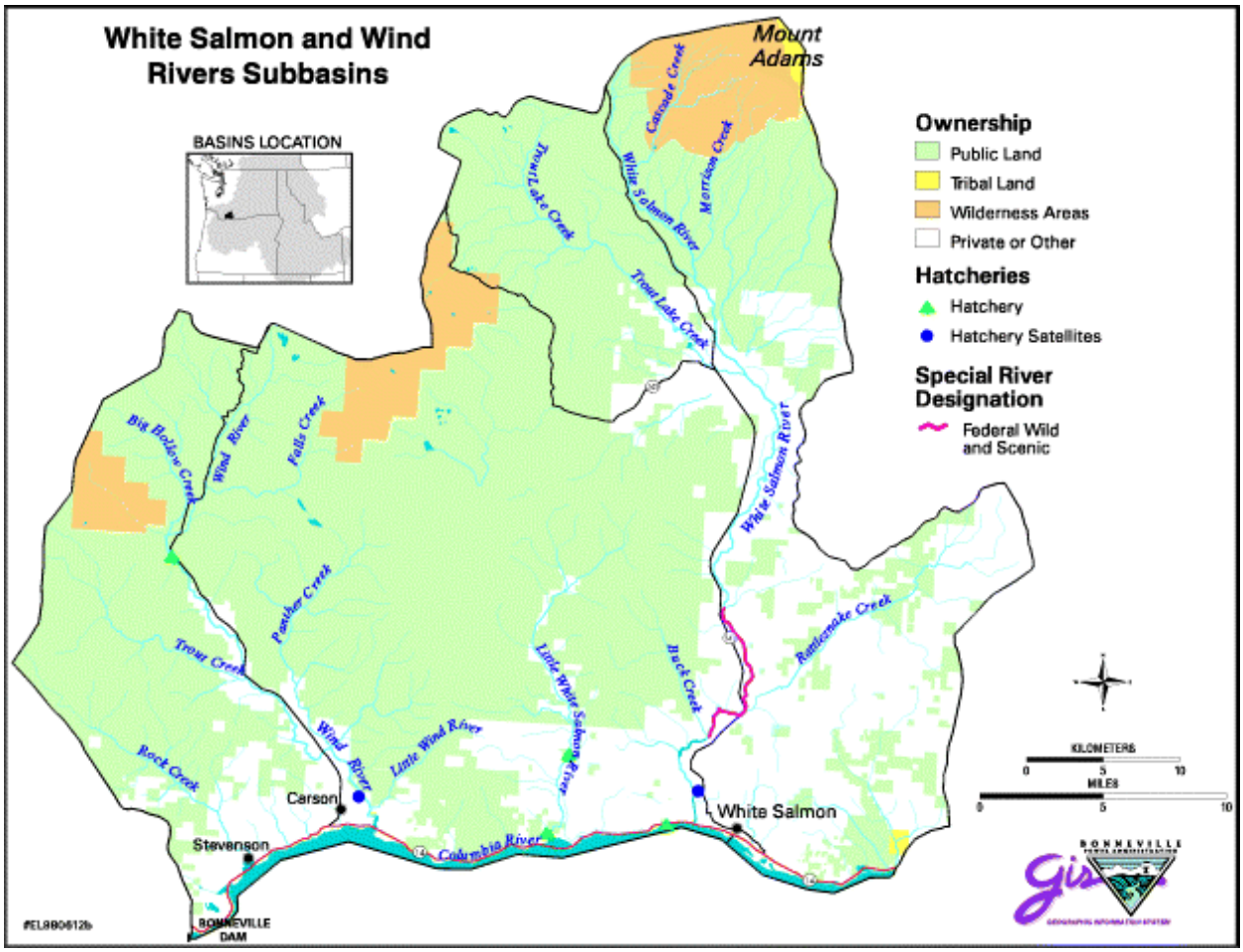

Figure 1. Location of the Wind in the Columbia River Subbasin Gorge Province

Drainage Area

Wind River, a fifth order stream, drains approximately 225 mi² of Skamania County over a distance of approximately 31 miles. Principle tributaries to Wind River include Little Wind River, Bear, Panther, Trout, Trapper, Dry, Nineteenmile, Falls and Paradise creeks. The largest tributary, Panther Creek, enters at RM 4.3 and drains 18% of the Wind River

subbasin (26,466 acres). Trout Creek, which drains 15% of the subbasin (21,732 acres), enters at RM 10.8.

Climate

Climatic patterns of the Wind River subbasin are controlled by marine-influenced air masses from the Pacific Ocean. The mean annual average precipitation in this watershed is 110 inches per year at Stabler, Washington (elevation 800 feet). Approximate 80% of the precipitation is delivered in the form of rainfall or snow between October and April. The average ambient air temperature is 66 F during the summer and 40 F in the winter.

Topography/geomorphology

The basin is oriented northwest to southeast with elevations ranging from 80 - 3,900 feet. Topography varies within the watershed; it is steep in the northwest and lower southeast, gentle in the northeast - McClellan Meadows area, and it is benchy in Trout Creek Flats and middle portions of the Wind River Valley. The mainstem of the Wind River drops 3,820 feet in 30.5 miles for an average gradient of 2.3%. Shipherd Falls, located at RM 2.0, is a series of four falls ranging from 8 to 12 feet that were a barrier to all anadromous salmonids except steelhead until the construction of a fish ladder in 1956.

Stream flows in the watershed range from summer low flows to peak flows in the winter. Some streams only flow during high flow events and are dry the remainder of the year (ephemeral streams). Others such as the mainstem of the Wind River increase from an average daily flow of less than 250 cubic feet per second (cfs) during August and September to over 2,000 cfs in December and January. The largest stream flows typically occur in response to rain-on-snow events, when heavy rains combine with high air temperatures and high winds to cause widespread snowmelt. Low flows are maintained by late season snowmelt and areas of water retention or recharge.

Geology and Soils

The Wind River Watershed has been shaped through 25 million years of volcanic activity and glacial action. Most of the watershed was formed 12 and 25 million years ago with some younger flows out of Indian Heaven and Trout Creek Hill being dated between 350,000 to three million. The flows out of Trout Creek Hill are the youngest at about 300,000. The majority of the watershed is in the older volcaniclastic material. These areas are more susceptible to erosion and mass failure due to the weathering of the material to silts and clays.

Glacial activity has had an effect on the landscape especially in the upper regions of the watershed by Indian Heaven, where volcanic flows have scoured and smoothed the land. Outwash and alluvial material from this time period have been eroding down through the Wind River Valley. Since the construction of Bonneville Dam, this material has been accumulating at the mouth of the Wind River. Other material that has been moving into the streams in the lower parts of the valley are flood deposits left from the Bretz Floods from ancient Lake Missoula. Sediment input has also resulted from large landslides in the watershed.

Most subbasin soils originate from weathered bedrock. Alluvial soil is found along the river and some soils north of Paradise Creek were buried under a thin layer of ash and

pumice from Mt. St. Helens. Major woodland soils are deep and well drained but become shallow as elevation increases. Soils above 4,000 feet are subject to cold temperatures, while those along the Columbia River are subject to high winds.

Vegetation

Presently, vegetation is approximately 90% Douglas fir, western hemlock and grand fir. Prior to European settlement, the forest of the Wind River Basin contained either late-successional old growth or early-successional young growth. Late-successional stands contain trees over 21 inches in diameter with multiple canopy layers. Mid-successional stand also contain trees with diameters over 21 inches but with a single canopy layer consisting of nine to 21 inch trees. Early-successional stands consist of trees from 0 to 9 inches. Table 1 displays the number of acres in each successional class and how the proportions changed over time to the present day.

Table 1. Amount of acres in each successional class and changes in vegetative seral stages from 1850 – present.

Period	Non-Forest	Early-Successional	Mid-Successional	Late-Successional
Circa 1850	6,700	40,700	12,485	83,556
Circa 1900	7,600	22,000	51,200	62,638
Current	9,887	34,118	67,628	31,816

Major Land Uses

The Wind River Subbasin is part of the Yakama Indian Nation lands ceded to the United States in the Treaty of June 9, 1855. Within this area the tribe reserves the right to hunt and fish at all usual and accustomed places in common with citizens of the territory. The upper portion of the basin is situated within the legislated boundary of the Gifford Pinchot National Forest (GPNF) and federal ownership accounts for 127,682 acres (89%) of the watershed. Non-federal ownership includes Washington Department of Natural Resources (WDNR) at 3,757 acres (2%), private timber interests at 8,122 acres (6%), and other private ownership at 3,943 acres (3%). Most of the first six miles of mainstem river and its drainage are outside the GPNF, but a large portion of this area lies within the Columbia River Gorge National Scenic Area (CRGNSA). The remaining 25 mainstem miles consist primarily of U.S. Forest Service (USFS) ownership. The President's Forest Plan (ROD) categorizes the Wind River Basin as a Tier 1, Key Watershed that provides habitat for anadromous salmonids.

The Wind River drainage has traditionally been managed for timber production; however, under the Northwest Forest Plan, much of the drainage has been designated as late successional reserves, wilderness areas (wilderness areas pre-dated the Forest Plan), riparian reserves, or reserved through other means. In addition to the GPNF and DNR, there is a limited amount of commercial timberland ownership in the lower valley. Those holdings within the CRGNSA are regulated by their land use regulations as administered by Skamania County. Those outside the CRGNSA are regulated by the Washington State Forest Practices Regulations.

Urban development has been concentrated in Carson, Washington which is located at RM 2 and Stabler, Washington at RM 7. There are individual dwellings throughout the first 12 miles of the river, with the majority located in the lower reaches. In addition, a number of vacation cabins are located near Government Mineral Springs along Trapper Creek. These cabins are privately owned on land leased from the USFS. Large-scale industrial activities are limited by lack of available land outside the National Forest and Scenic Area. The two major industrial operations in the watershed are a plywood mill on the east side of the river near the mouth and a lumberyard north of Carson. Both are owned and operated by the WKO Company. A gold mine is operated near the Upper Wind River approximately one mile south (downstream) of the mouth of Paradise Creek. In addition, the USFS recently conveyed approximately 190 acres and infrastructure of former nursery land to Skamania County.

The river's proximity to the Portland/Vancouver area makes it a popular recreation destination for cross country skiing, tubing, sledding, fishing, mineral prospecting, swimming, golfing, camping, hiking, picnicking, waterfall viewing, hunting, and berry picking. In addition, the Wind River Valley is a significant transportation corridor for travelers, including significant summer tourism traffic. Forest Road 30, which follows the river through much of its length, offers access to the upper Lewis River basin and to the Mount St. Helens National Volcanic Monument.

Fish and Wildlife Status

Fish

Fish assemblages in the Wind River are divided into the area above and below Shipherd Falls. Species found downstream from the falls include spring and fall chinook, coho salmon, winter and summer steelhead, coastal cutthroat trout, largescale and bridgelip suckers, pacific and brook lamprey, threespine stickleback, sculpins, white sturgeon, redside shiners, peamouth, and northern pikeminnow. Historically, pink and chum salmon likely used this area but are believed to be extirpated. Species found upstream of the falls included steelhead trout, shorthead sculpin, mountain whitefish, brook trout (non-endemic) and spring chinook salmon (non-endemic). No anadromous fish except unmarked steelhead are allowed above Hemlock Dam on Trout Creek (Figure 1). Shorthead sculpin is found in most areas except upstream of the canyon area of Trout Creek (Figure 1), which has numerous small falls that are potential barriers to this sculpin's upstream distribution. Mountain whitefish, brook trout, and spring chinook occur in limited areas of the watershed, and wider occurrence is limited by habitat requirements and preferences. Fish surveys and smolt trap catches indicate limited natural reproduction of spring chinook. Sockeye salmon, coho salmon, lamprey (one or more species), and brown trout have recently been observed above Shipherd Falls.

Steelhead (Threatened, Lower Columbia ESU, 3/98)

Natural spawning of summer and winter steelhead in the Wind River occurs in upper mainstem reaches, Trout Creek, Panther Creek, and lower reaches of nearly every major tributary (Figures 2 and 3). Until recently, Trout Creek accounted for a large amount of total spawning, but the annual adult return to Trout Creek has declined from over 100 in

the 1980s to less than 30 in the 1990s. Prior to construction of a ladder over Shipherd Falls, steelhead were the only anadromous salmonid known to pass the falls successfully.

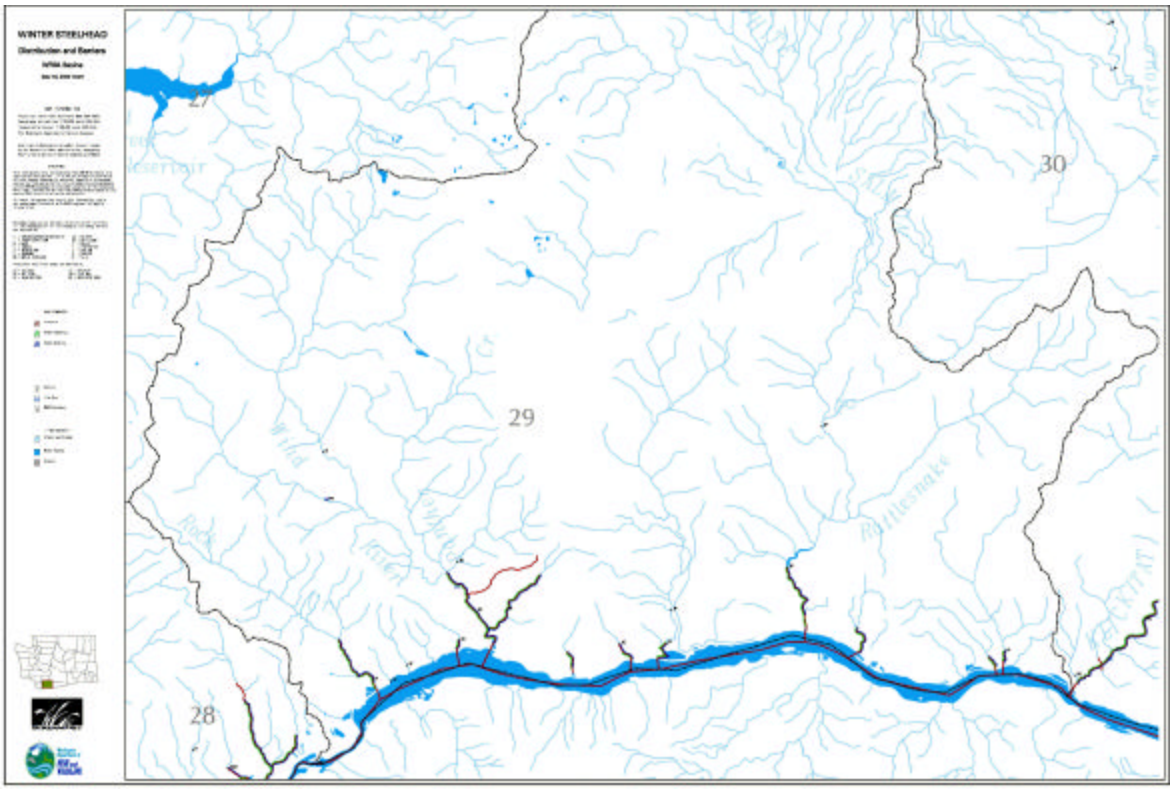

Figure 2. Distribution of winter steelhead in the Wind River Subbasin

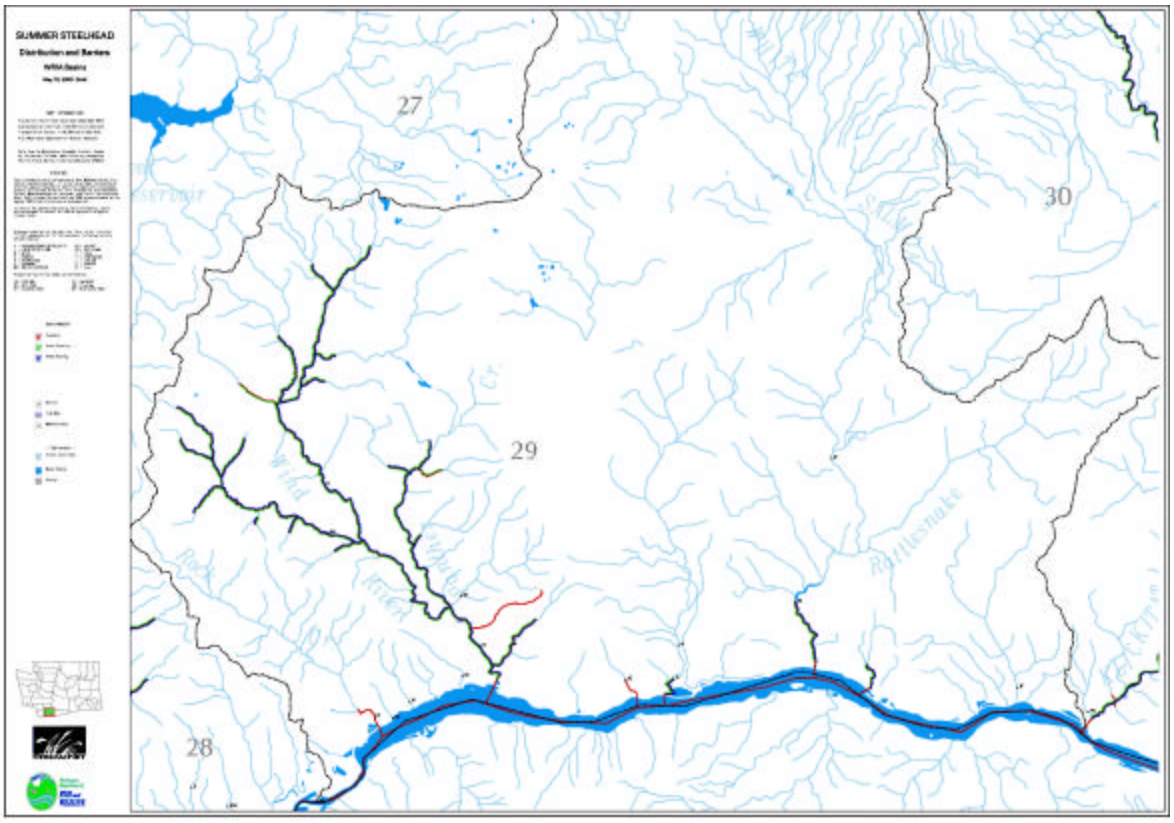

Figure 3. Distribution of summer steelhead in the Wind River Subbasin

Size of historical spawning populations is not well documented, but historic run size has been estimated at 2,500 fish (Bryant 1951). The current escapement goal for wild summer steelhead is 1,000 adults, most recently met in the mid-1980's. In 1999, WDFW initiated a mark-recapture study for wild summer and winter steelhead. Preliminary estimates indicated that less than 200 wild summer steelhead returned in 1999. Based on redd and snorkel surveys, the abundance of wild summer steelhead has declined since the late 1980s (Figure 4).

Data from these surveys serve as an index of population strength and change, rather than estimates, of population numbers because redd surveys cover a small portion of the basin and snorkel surveys occurred before the entire run entered the basin. Currently, a population estimate is unavailable for adult wild winter steelhead. Wild steelhead smolt production has been monitored for the entire subbasin and in key tributaries since 1995. Steelhead smolt yields for the basin during this period of time have been increasing (Figure 5).

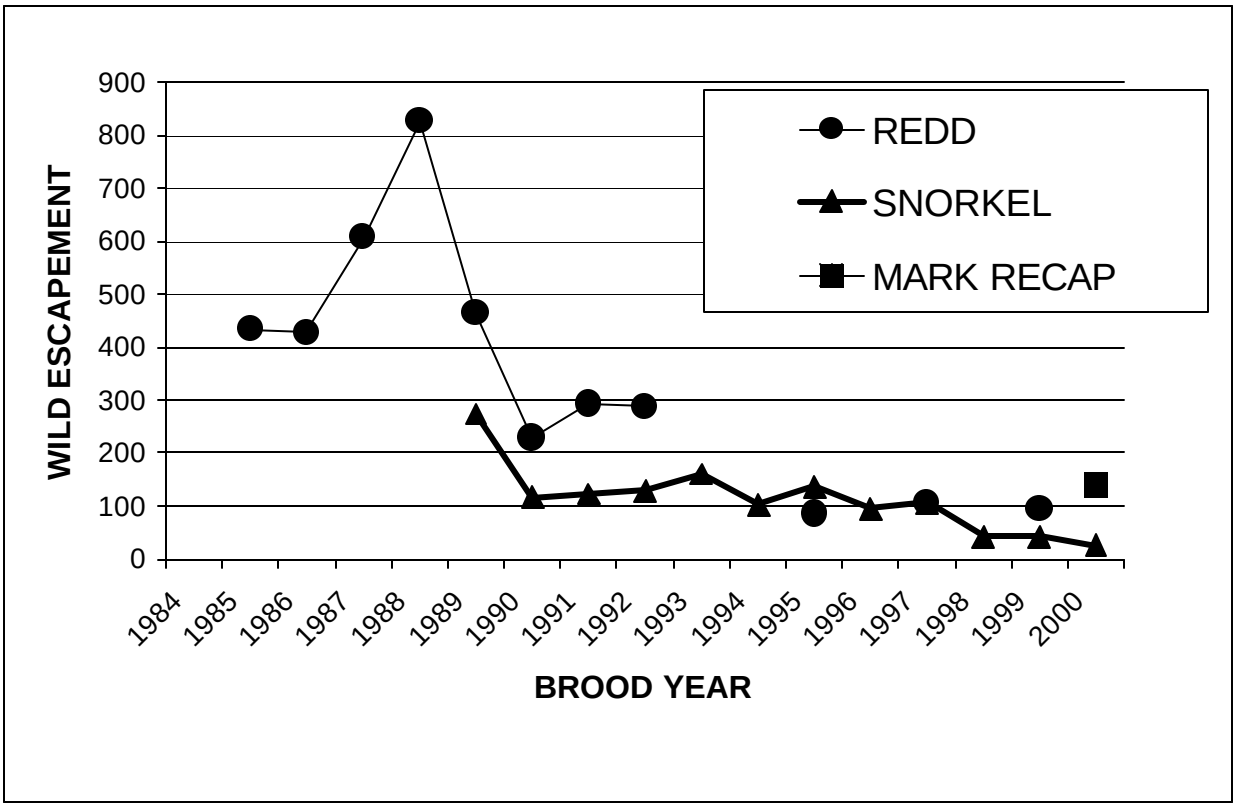

Figure 4. Wild summer steelhead abundance trends for the Wind River in the Columbia Gorge Province

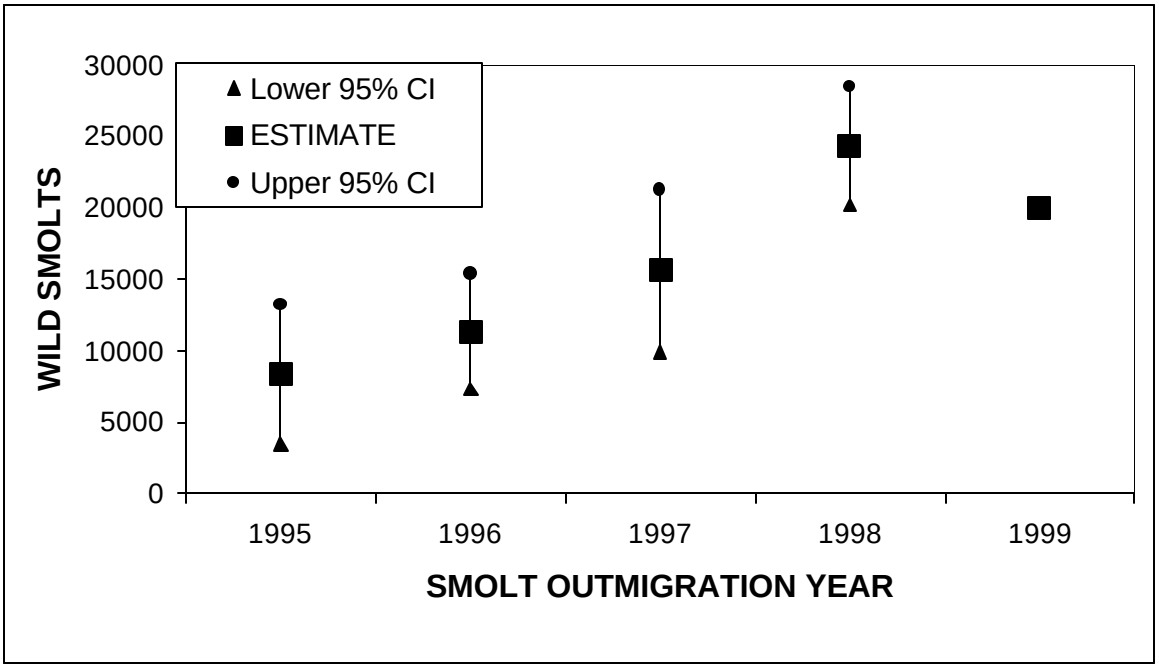

Figure 5. Wild steelhead smolt yield in the Wind River, Columbia Gorge Province from 1995-99

Surveys in the mid-1980s and late 1990s found juvenile steelhead in all major tributaries accessible to returning adult steelhead, including Paradise, Dry, Trapper, Trout, and Panther creeks. Surveys in the late 1990s indicated juvenile steelhead were present in streams surveyed in the mid-1980s (Figure 6). However, densities and biomass of juvenile steelhead in the late 1990s were less than or similar, but never those from the mid-1980s. As described in Connolly (1997), juvenile steelhead in some areas of the watershed have high infestation of the ciliated protozoan *Hydropolaria lwoffi* (formerly *Epistylis lwoffi*). Connolly's data suggests that growth and survival of steelhead are negatively effected by this organism. However, additional evaluations are required.

Skamania Stock summer steelhead have been released in the Wind River watershed above Shipherd Falls most years since 1960. Releases of smolts were suspended in the early 1980s when WDG began managing the Wind River intensively for wild summer steelhead. Releases of adipose-clipped smolts were reinstated in the mid-1980s, and the river has been managed under catch-and-release regulations for wild steelhead since that time. Angling closures and size-restrictions have been established to decrease angler take of juvenile steelhead and smolts. Due to concerns about negative ecological and genetic interactions with wild steelhead, hatchery releases of catchable rainbow trout were discontinued in 1994 and releases of hatchery steelhead were discontinued in 1997. An adult trap has been operated at RM 2 on Trout Creek since 1993, and hatchery fish have been excluded from this tributary to preserve and maintain genetic diversity of the wild stock. Recent genetic analyses by WDFW indicated genetic differences between hatchery and wild steelhead have been maintained. Due to the lack of reproductive success of the Skamania hatchery strain in the wild, the exclusion of hatchery fish in Trout Creek, and the results of genetic analyses, WDFW believes that natural production in the watershed is primarily sustained by wild fish.

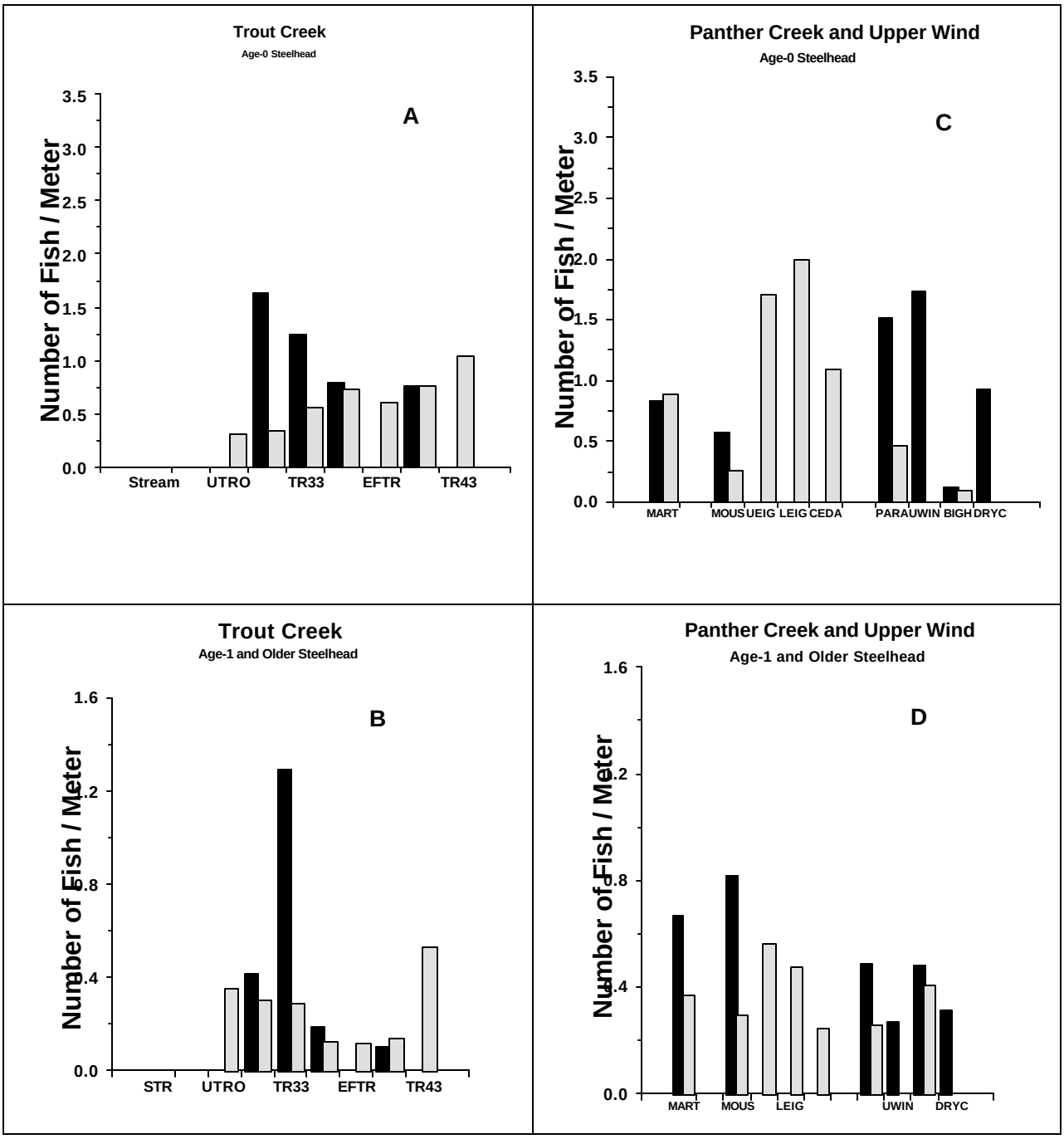

Figure 6. Comparison of abundance estimates of juvenile steelhead in tributaries of Trout Creek (A, C), Panther Creek (B, D), and upper Wind River (B, D) watersheds for surveys conducted during 1984-88 (dark bars) by USFS (unpublished data) and WDFW (Crawford et al. 1986) to surveys in 1996-99 (light bars conducted by USGS-CRRL (Connolly, unpublished data). Absence of bars indicates no data were available

Chinook salmon (Threatened, Lower Columbia ESU, 3/99)

Natural spawning of spring chinook in the upper Wind River did not occur until passage facilities were built at Shipherd Falls. After passage was provided, a spring chinook run was established at the Carson National Fish Hatchery (CNFH), and natural spawning began in habitats above and below the hatchery. Most juvenile chinook have been found in the mainstem Wind River above the hatchery but occasionally higher densities were recorded in tributaries including Compass, Crater, Planting, Trout, and Trapper creeks after hatchery outplanting (Figure 7). In two years of smolt trapping below one of the primary spawning areas (above the CNFH) only four unclipped chinook smolts were observed, which equates to 16 naturally produced smolts. The WDFW believes the majority of naturally spawning fish are hatchery strays, and that this population is not self-sustaining. Currently, spring chinook salmon in the Wind River are managed for hatchery production.

Natural spawning of tule fall chinook in the Wind River occurs in the mainstem below Shipherd Falls (Figure 8). Spawning also may occur in the Little Wind River, but surveys have not been completed for this tributary. Completion of Bonneville Dam inundated the primary habitat in the lower Wind River. Natural production is likely composed of naturally produced adults and hatchery strays. Tule fall chinook escapement is shown in Figure 9.

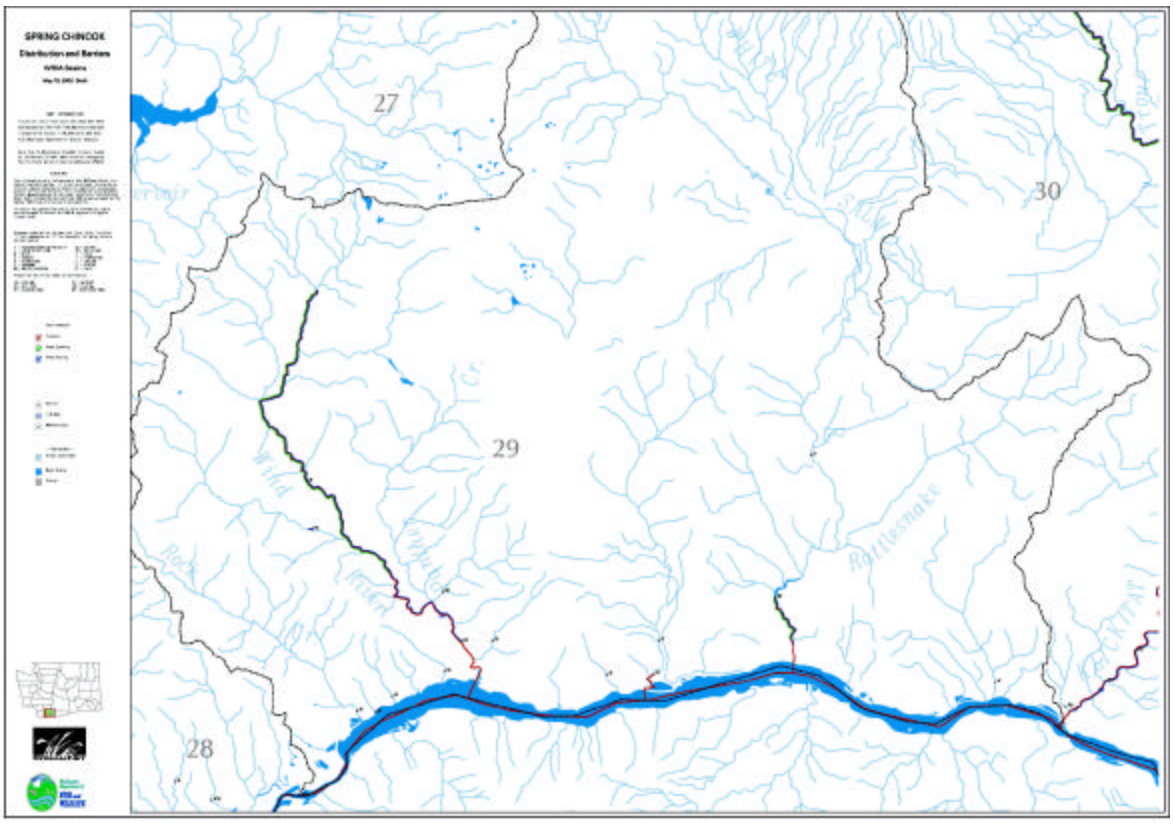

Figure 7. Distribution of spring chinook in the Wind River Subbasin

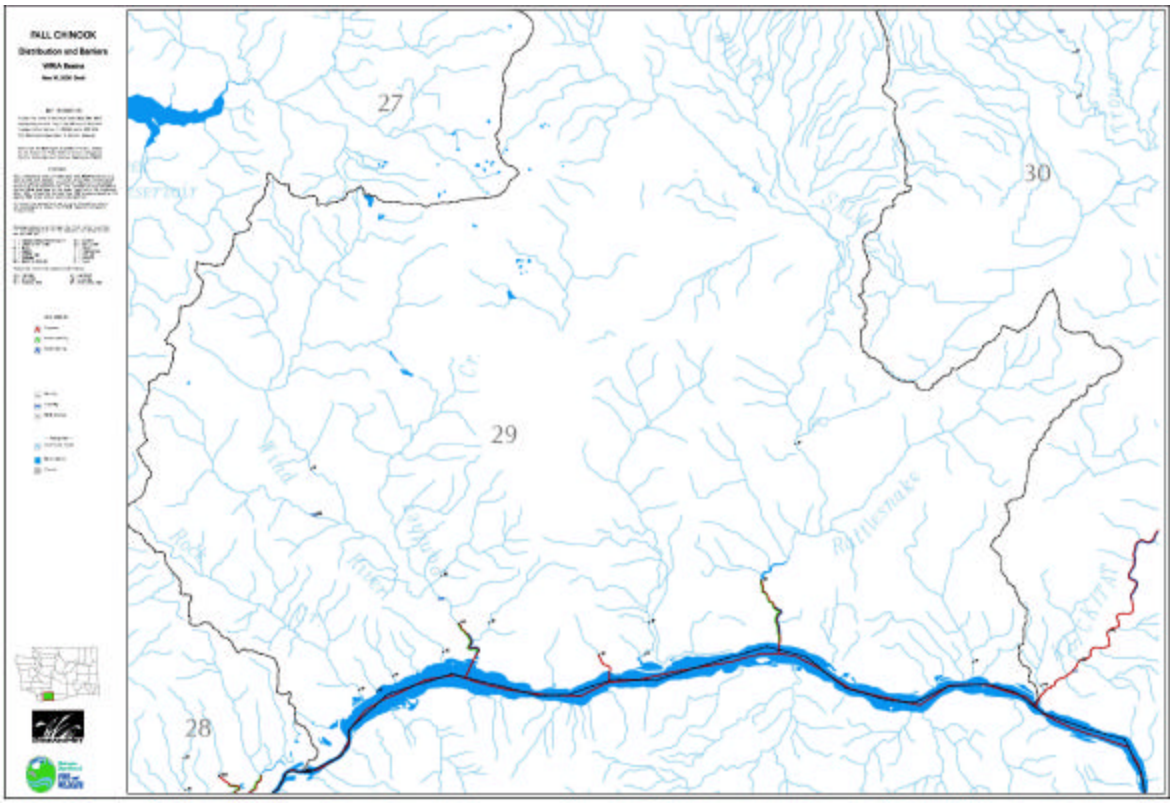

Figure 8. Distribution of fall chinook in the Wind River Subbasin

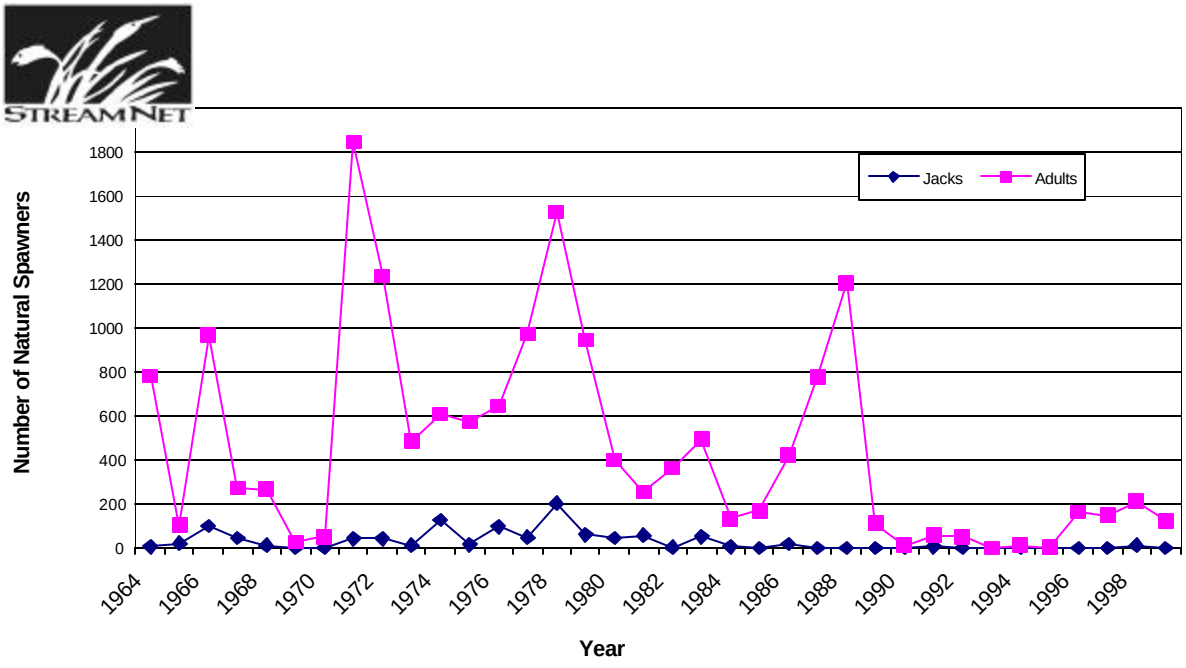

Figure 9. Wind River tule fall chinook abundance estimates, 1964-2000

Naturally produced fry are observed each year in the lower Wind River smolt trap indicating that fall chinook are successfully spawning. Tule fall chinook in the Columbia Basin have primarily been managed for hatchery production.

Bright fall chinook salmon originated from the Columbia River above McNary Dam. These fish have been reared at Bonneville and Little White Salmon hatcheries to mitigate for chinook salmon lost due to the construction and operation of mainstem Columbia River dams. Stray brights from these facilities have been observed in the Wind River and natural production of bright fall chinook occurs in the Wind River. Bright fall chinook salmon tend to spawn later than tule fall chinook and the abundance of bright fall chinook salmon has been enumerated since 1988 in the lower Wind River (Figure 10).

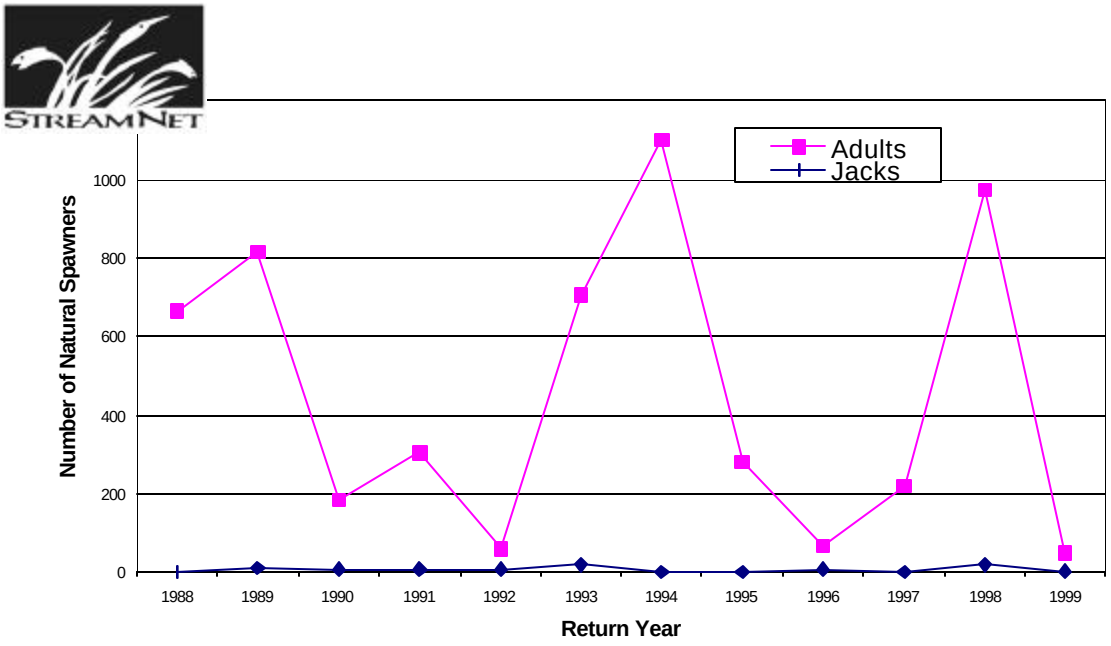

Figure 10. Wind River bright fall chinook abundance, 1988-1999

Bull Trout (Threatened, 1998)

The status of bull trout in the Wind River is unknown. Bull trout have been observed in the lower river below Shipherd Falls (Figure 11) and managers believe these fish are part of an adfluvial population, which uses the Bonneville Pool. The WDFW has initiated a bull trout sampling project in the Columbia Gorge Province to determine the distribution of bull trout in the Wind River and other Washington tributaries. Until this project is completed, there is insufficient information to determine distribution, assess population status, or develop a recovery plan for these fish.

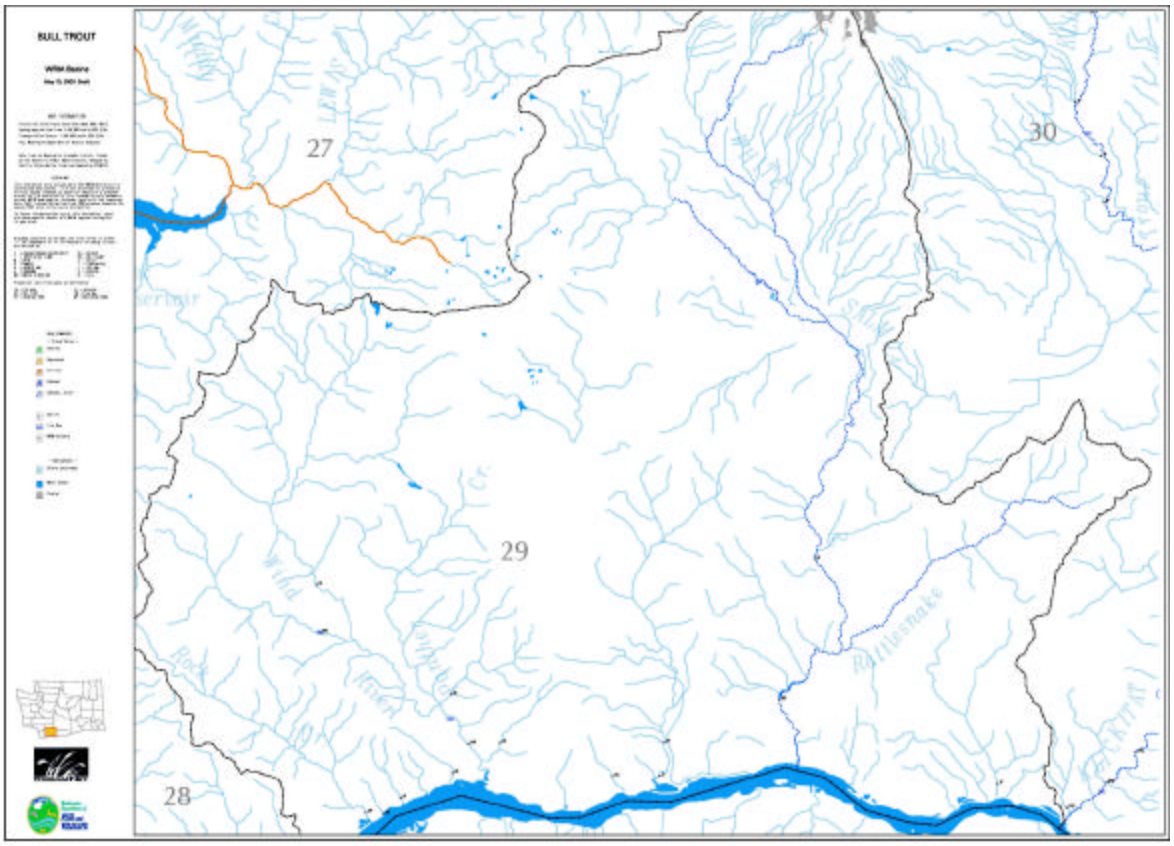

Figure 11. Distribution of bull trout in the Wind River Subbasin

Coastal cutthroat trout (ESA candidate)

Coastal cutthroat trout occur in the watershed, but the historic and recent distribution and status of this species are unknown. Historical distribution may have been limited to below Shipherd Falls, with the Little Wind River likely providing suitable habitat. Reports of cutthroat trout occurring above Shipherd Falls do exist, but they appear to be after hatchery cutthroat had been released into the watershed above Shipherd Falls. Hatchery cutthroat releases occurred as early as the 1930s, but were discontinued 30 years ago. Personnel from USGS-CRRL have not observed cutthroat trout during recent (1996-99) surveys in first and second order tributaries accessible to anadromous fish throughout the watershed above Shipherd Falls. Personnel from WDFW have observed one coastal cutthroat in five years of smolt outmigration monitoring at the lower Wind River trap located below Shipherd Falls. Because of limited information and lack of sampling that specifically targeted cutthroat trout, the status of coastal cutthroat trout in the watershed is unknown. However, if coastal cutthroat trout are present, the population number appears to be very low, the distribution appears to be very limited, and the sea-run form may be extirpated.

Coho (ESA candidate, Lower Columbia ESU, 7/95)

A small spawning population of coho persists in the Wind River. The WDFW believes that upstream adult coho distribution was limited to the area below Shipherd Falls (Figure 12). Although hatchery coho are not released in the basin, a few were observed at the Shipherd

Falls adult trap in the fall of 1999 during the first year of adult trapping. Smolt trapping in the lower Wind River during the last five years has produced few wild coho smolts. This indicates that current natural production for coho is low and hatchery strays are likely the source of any natural production.

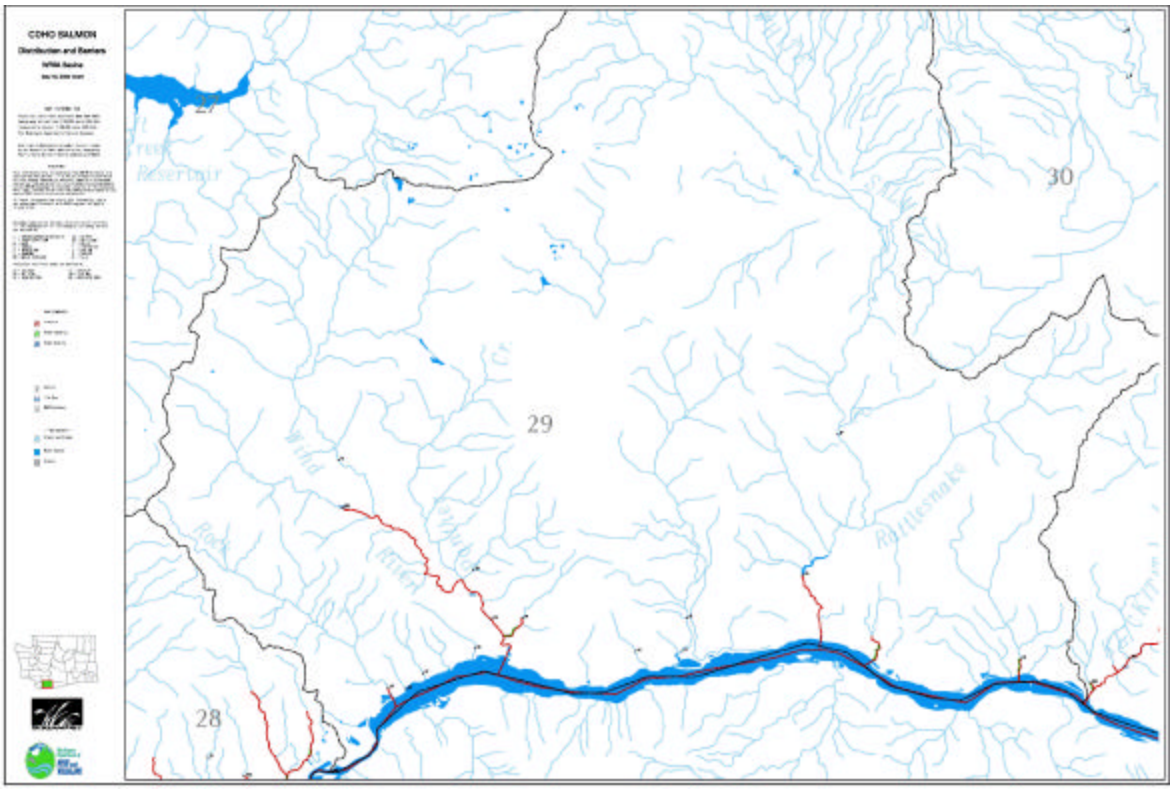

Figure 12. Coho distribution throughout the Wind River Subbasin

Resident Rainbow

Resident rainbow trout are native to the Wind River drainage and occur sympatrically with steelhead within and above the anadromous zone. Initially, hatchery trout were stocked throughout the basin with most confined to Hemlock Lake in Trout Creek to provide local anglers recreational opportunity. Due to concerns about declining steelhead in Trout Creek, the Hemlock Lake program was terminated in the early 1990's. When juvenile steelhead/rainbow trout were collected for genetic analysis in the 1990's, there was no evidence of hatchery rainbow trout introgression in these collections. The status of rainbow trout is unknown at this time.

Brook Trout

Brook trout are non-indigenous to the Wind River watershed. Hatchery releases have been discontinued but naturally reproducing populations have been established within the Wind River. Brook trout densities are highest in upper Trout Creek and Tyee Springs (Connolly et al. 1999). In these areas they are likely to compete with native rainbow/steelhead populations. The status of brook trout populations is unknown at this time.

Pacific Lamprey – YIN Species of Concern

Pacific lamprey have been observed in the Wind River Subbasin above and below Shipherd Falls. Pacific lamprey were historically and are currently important to the Yakama Indian Nation. The current status of the species is unknown.

Wildlife

Black-tailed deer - (WDFW Priority Species)

Black-tailed deer inhabit most of western Washington and extend their range east of the Cascades in the Columbia River Gorge. Typically, black-tailed deer reside in finite home ranges in the lower elevation temperate forests. Along the Cascades there are specific migration patterns from winter and summer ranges. The Wind River is considered important black-tailed deer habitat and the majority of the upper drainage is in the Gifford Pinchot National Forest (Raedeke, K. 1989 draft rpt.). The lower drainage is considered important deer winter range and specific habitat has been identified by the USFS. Timber harvest and conversion to residential land patterns threaten to reduce the carrying capacity of the lower drainage to support wintering migratory deer.

Fisher ("Endangered" in Washington, 10/98; Federal "Species of Concern")

The Wind River Subbasin is part of the historical range of the fisher (Figure 13). Overtrapping, and loss and alteration of habitats are considered the most significant reasons for the decline of fishers in Washington. Although extensive surveys for fishes have been conducted throughout their historical range, no known population of fishers exists in Washington. The apparent absence of fishers in Washington represents a significant gap (i.e., lack of population continuity) in the species range from Canada to Oregon and California. Riparian habitats, especially those with large diameter snags, live trees and downed logs, are considered high quality habitats for fishers, especially for resting and reproduction. Loss and fragmentation of these habitats can limit the suitability of a landscape for fishers. Oregon now has a resident population of fishers in the Cascades that could serve as a source population for Washington. However, the Bonneville Dam makes the Columbia River a more formidable barrier for fisher dispersal from Oregon to Washington.

Larch Mountain Salamander ("Sensitive" in Washington, 1993)

The Larch Mountain Salamander has a restricted range, and is almost entirely endemic to a small area in Washington. Its known distribution includes west-side habitats of the southern Cascades region in Washington and the Columbia Gorge area of Oregon and Washington. This range includes the Wind River Subbasin. Larch Mountain salamanders require cool, moist environments in upland areas. Nearly all populations have been found on steep talus slopes in forested areas. They are also found in steep slopes in older forests, under woody debris on the forest floor or in detritus at the base of a snag. They are vulnerable to disturbances such as logging, rock extraction, and inundation that can alter these habitats and make them unsuitable. As the species is patchily distributed in the landscape, disturbances at the local level may negatively impact the population as a whole.

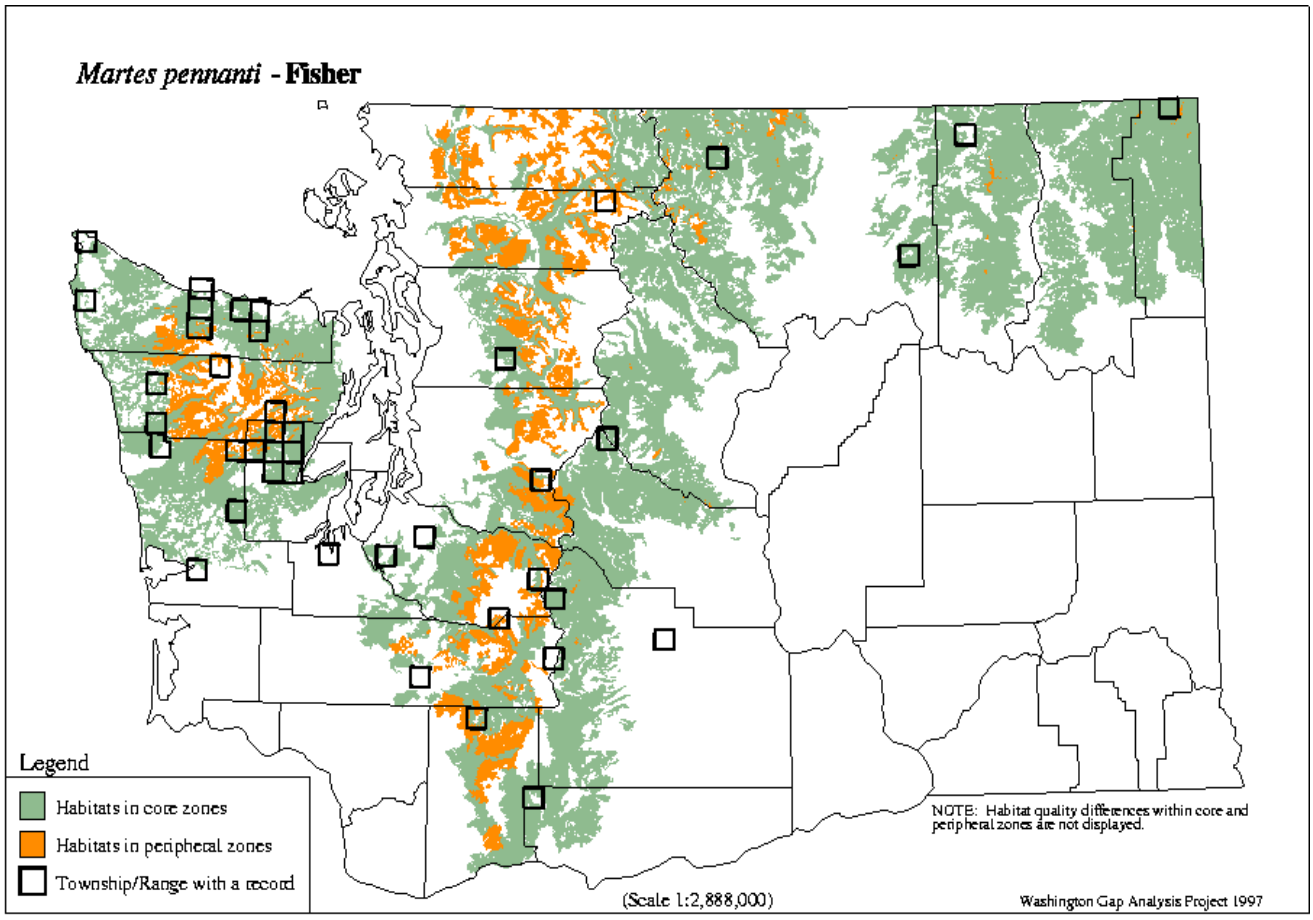

Figure 13. Distribution of the fisher in Washington

Band-tailed Pigeon (WDFW Priority Species)

The band-tailed pigeon breeds throughout much of Western Washington (Figure 14). It is a species that has specific habitat requirements for reproduction. The band-tailed pigeon requires mineral springs as a source of calcium for egg-laying and the production of crop-milk for its young. The proximity of these mineral springs to suitable foraging habitats is also an important factor for band-tailed pigeons. A mineral spring located in the lower reach of the Wind River has one of the highest concentrations of pigeon use in the state. Current threats to this resource include timber harvest and increased disturbance from recreational development near these mineral springs.

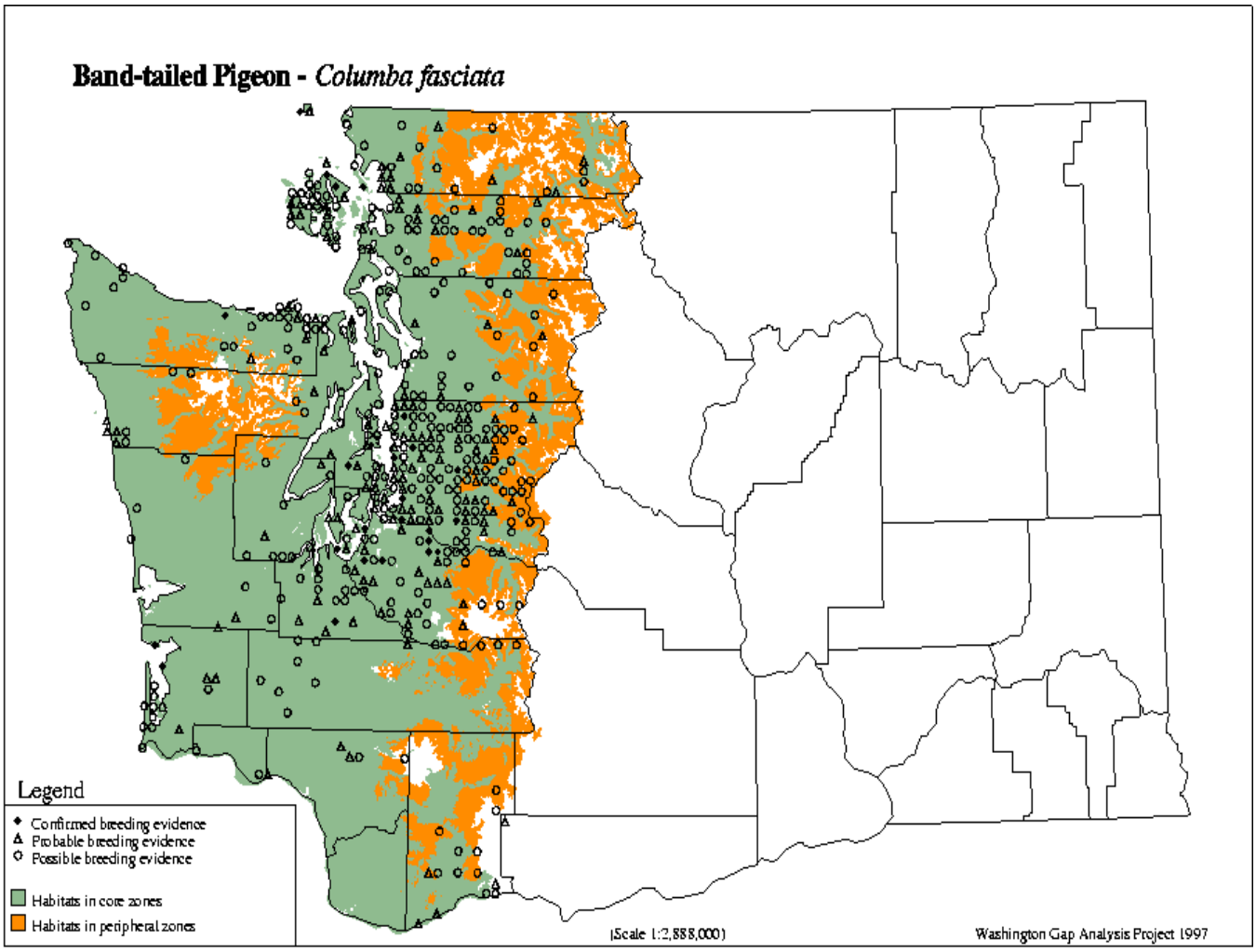

Figure 14. Distribution of band-tailed pigeon in Washington

Riparian Bird Guild

A great number of bird species are associated with or require riparian habitats in the Wind River Subbasin. As a subset of this guild, neotropical migrants (e.g., willow flycatcher, yellow warbler, yellow-breasted chat, red-eyed vireo, Vaux's swift) continually exhibit declining population trends in this region. Lewis's woodpeckers were historically common in cottonwood habitats of the Columbia River but declines were noted after 1965 and they are now considered extirpated from the Columbia River riparian habitat. The yellow-billed cuckoo is a riparian obligate species that was once common along the Columbia River but has not been reported in this area since 1977. Other species that are marsh obligates include the Virginia rail, sora rail, and marsh wren. Loss of riparian and riparian-marsh habitat for these birds resulted from the inundation and alteration of habitats in the Wind River Subbasin and in the mainstem of the Columbia River.

Western pond turtle (WDFW endangered species)

The western pond turtle is listed by Washington State as an endangered species and has been extirpated from most of its range in Washington. The species requires a continued recovery program to ensure its survival in the state until sources of excessive mortality can be reduced or eliminated.

Two populations of the species remain in the Columbia River Gorge (Figure 15). The total number of western pond turtles in known Washington populations is estimated at 250-350 individuals, approximately half of which went through the head-start program at the Woodland Park Zoo. Additional turtles may still occur in wetlands that have not been surveyed in western Washington and the Columbia Gorge. Currently, WDFW is working on Western Pond Turtle recovery in habitat near the mouth of the Klickitat River. The goal of the recovery program is to re-establish self-sustaining populations of western pond turtles in the Columbia Gorge region. The recovery objectives are to establish at least 5 populations of >200 pond turtles, composed of no more than 70% adults, which occupy habitat that is secure from development or major disturbance. It is also necessary that the populations show evidence of being sustained by natural recruitment of juveniles. The core pond turtle sites should be wetland complexes that may be less susceptible to catastrophes than sites of a single water body. The recovery objectives need to be met before the western pond turtle would be considered for downlisting to threatened. Objectives for downlisting to sensitive are similar, except those 7 populations of >200 pond turtles will be needed.

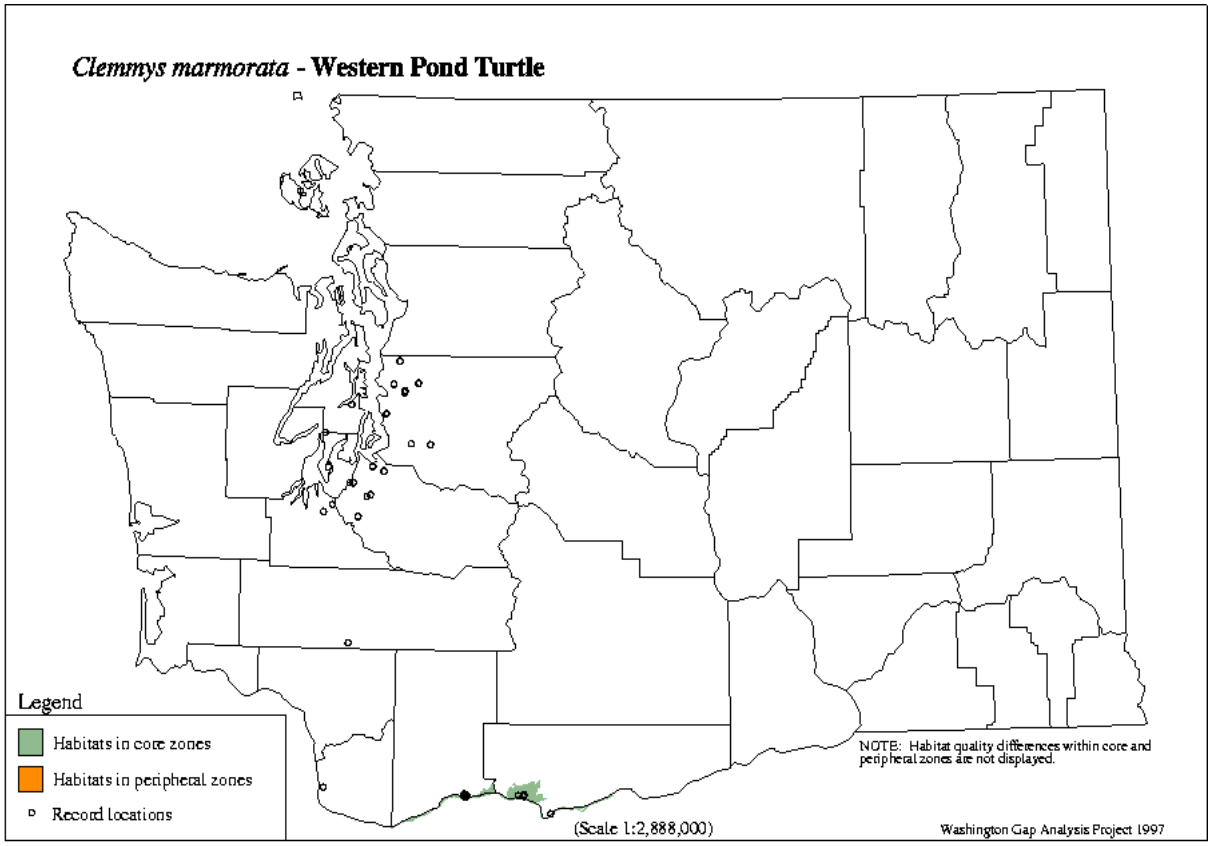

Figure 15. Distribution of Western Pond Turtle in Washington

Habitat Areas and Quality

Current habitat conditions are the result of natural and stochastic events. In the Wind River these events include volcanic eruptions, earthquakes, fire, erosion/sedimentation, steam bank vegetation, large woody debris, and peak flow (USFS 1996). Human activities including riparian and upslope timber harvest, hydro and splash damming, water withdrawal, road building, and rural development have negatively affected fish and wildlife habitat.

Fish

The USFS classified stream channels in the Wind River based on the Rosgen classification system, which incorporates channel slope, meander width ratio, channel entrenchment, sinuosity, and width to depth ratio. Channels were classified as A, B, C, or E (USFS 1995). Low gradient meandering stream channels (generally Rosgen C and E channels) contain substrate and water velocity preferred by salmonids for spawning and early rearing. In addition, coho and chinook salmon prefer these channels for rearing to the smolt stage. Rosgen "A" and "B" channels have moderate to low sinuosity, moderate to low width to depth ratio, moderate to high gradient and high to moderate entrenchment. “A” and “B” channels are dominant in this watershed and provide excellent steelhead rearing habitat and limited spawning habitat. Rawding (1999a) summarized the movements of steelhead in Wind River from the available data. In general, steelhead adults holdover in the canyon areas of “B” channels, move into “C” channels or suitable spawning habitat in “B” channels for spring spawning. After emergence, fry seek out margin habitat of these channels for early rearing and most fish are likely to overwinter near their natal areas. At age one in the late spring and early summer, a portion of the parr migrate into “B” channels and remain there until they smolt at age two or three. Redd survey data indicate that the “C” channels in the Trout Creek flats, Panther Creek, Middle Wind, and Upper Wind have provided the highest spawning densities for steelhead. In contrast the “B” channels in the Lower Wind, Lower Panther Creek, and Lower Trout Creek have produced up to 75% of the smolts in the Wind River (Rawding 1999b).

Due to the diverse life history movements exhibited by steelhead in the basin, all anadromous habitat is important to steelhead for specific life history stages and it is essential to maintain the connectivity between these habitats. Human caused impacts to “B” channels are less than to “C” channels because riparian areas of “B” channels are less accessible, the increased stream gradient flushes sediment more efficiently, and the boulder-bedrock substrate maintains channel stability and natural pool/riffle ratios in “B” channels. As a general rule, “C” channels in the Wind River are more degraded and have poorer habitat quality as compared to “B” channels and “C” channels have been and will remain the focus of most restoration activities.

Anadromous fish have access to over 95% of the historic spawning and rearing habitat in the Wind River system. Minor blockages occur near the upper extent of steelhead use in the Wind River in Tyee Springs, Youngman Creek, and Oldman Creek. These blockages total approximately less than two miles of “B” and “C” channel habitat. The single largest loss of habitat occurred with the flooding of the lower Wind River after the construction of Bonneville Dam. The dam inundated the primary spawning area for fall chinook salmon and rendered the habitat unusable for this purpose.

The USFS manages 89% of the land within the Wind River subbasin. The President's Forest Plan (ROD) categorizes the Wind River Basin as a Tier 1, Key Watershed that provides critical habitat for anadromous salmonids. The quality of habitat in the Wind River Subbasin will be largely determined by federal management. Habitat is currently considered fair to excellent depending on the location. Some areas in the Trapper Creek wilderness are in pristine condition with excellent habitat. However, most habitat in the subbasin is degraded compared to historic conditions. Habitat problems noted in the subbasin plan are mainly related to timber harvesting practices and rural development. This is evidenced by maximum water temperatures exceeding 24° C (75° F), increased peak flows, increased sedimentation, lack of large woody debris, increased width-to-depth ratios, and lack of riparian vegetation (USFS 1996). Throughout the subbasin there continues to be a need to restore riparian vegetation, reduce sediment delivery to streams, enhance channel complexity, and ensure adequate recruitment of large woody debris into the system. The Washington Department of Ecology has designated stream segments of the Wind River subbasin as water quality impaired. The 303(d) list identifies segments that do not meet the standards of the federal Clean Water Act. DOE is presently conducting a TMDL for water temperature in this subbasin.

Wildlife

Riparian Habitat (Figures 16 and 17)

The majority of terrestrial vertebrate species use riparian habitat for essential life activities and the density of wildlife in riparian areas are comparatively high. Forested riparian habitat has an abundance of snags and downed logs that are critical to many cavity birds, mammals, reptiles and amphibians. This habitat is often characterized by relatively dense understory and overstory vegetation; cottonwood, alder, and willow are commonly dominant tree species in riparian areas. Riparian habitats are often forested, however they may contain important habitat subcomponents such as marshes and ponds that provide critical habitat for a number of species (e.g., Virginia rails, sora rails, and marsh wren). Riparian habitats also function as travel corridors between and connectivity to essential habitats (e.g., breeding, feeding, season ranges). Inundation of the lower reaches of the subbasin resulted in the loss of riparian habitat but also the loss of connectivity provided by that habitat along the Wind River to the Columbia River, and along the Columbia River to other subbasins.

Watershed Assessment

State and federal agencies, and tribes have completed various watershed assessments. In 1990, the Columbia Basin System Planning Salmon and Steelhead Production Plan was developed to identify options and strategies for increasing steelhead and salmon production in the Columbia River basin (WDFW 1990). The Wind River subbasin plan was one of 31 developed under the Columbia Basin Fish and Wildlife Authority. This plan documented the existing and potential production for winter and summer steelhead, spring and fall chinook, and coho salmon. It also summarized current management goals and objectives, and documented existing management efforts,

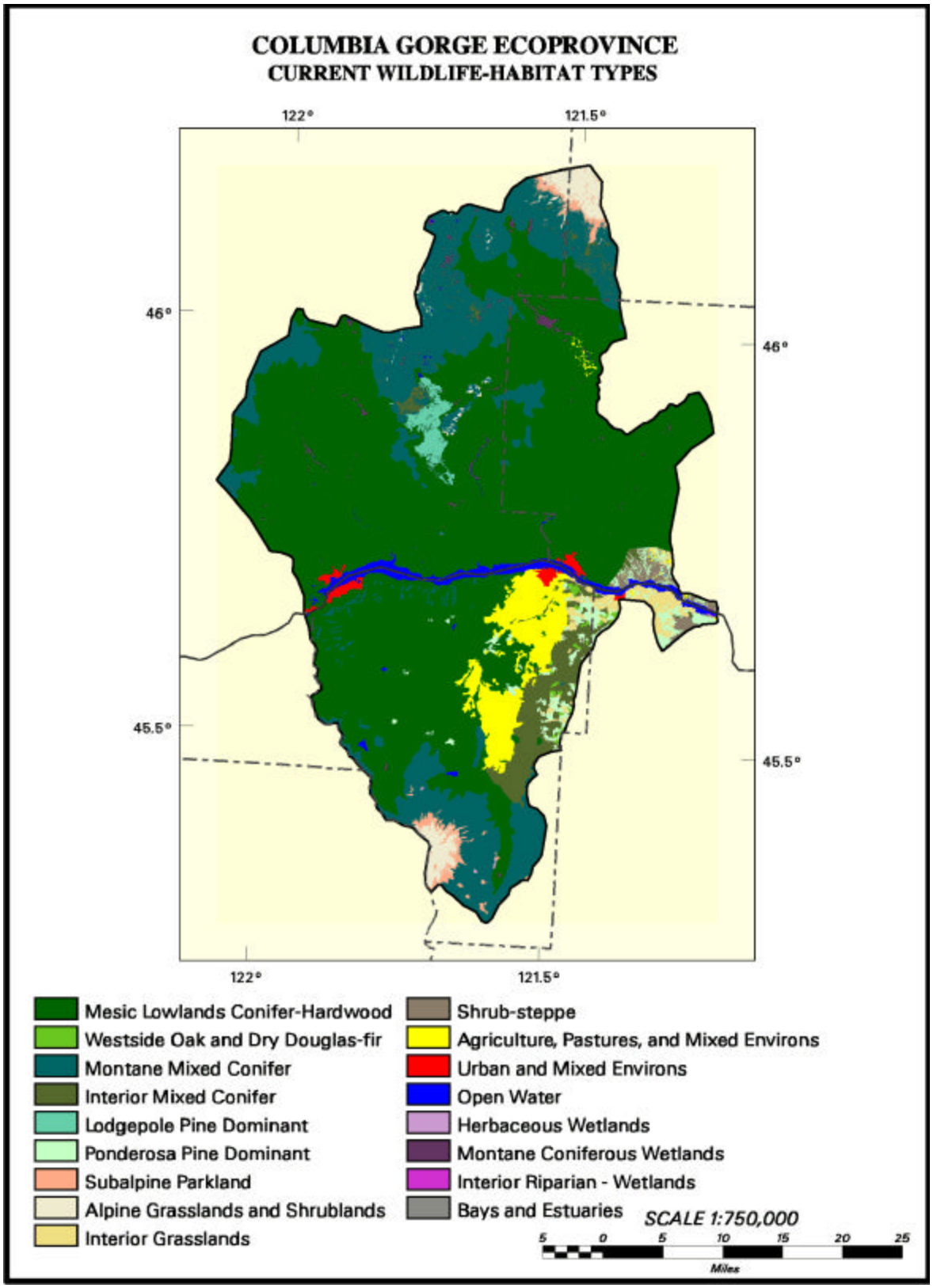

Figure 16. Current wildlife habitat types in the Wind River Subbasin

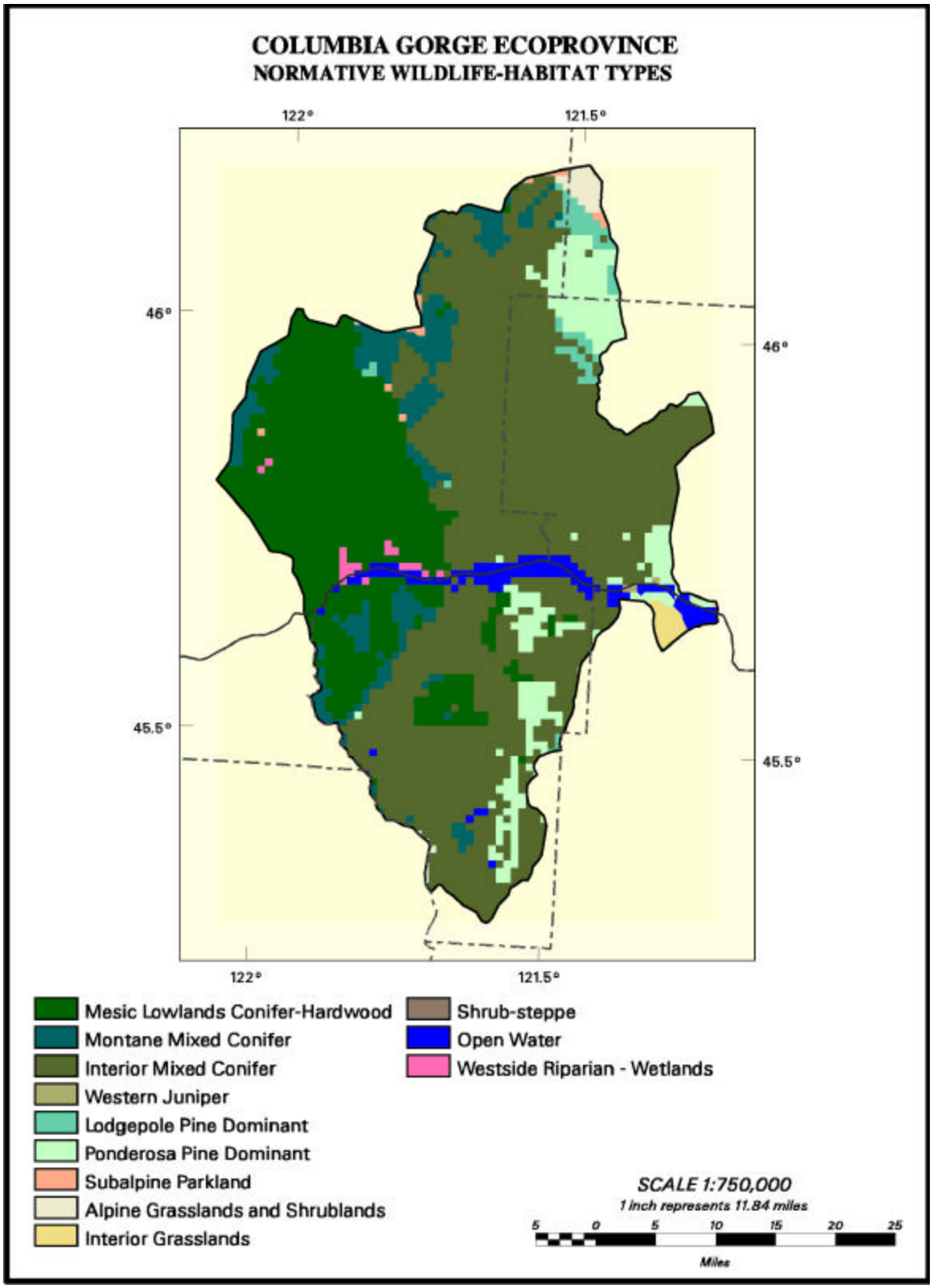

Figure 17. Normative wildlife habitats for the Wind River Subbasin

In 1992, the Trout Creek watershed was assessed and several habitat restoration projects were initiated in 1994. The USFS completed a watershed analysis for the Wind River in 1995, which included descriptions of the watershed's past and current condition, identified land ownership, topography, soil types, transmission corridors, designated wetlands, vegetation communities, fish and wildlife communities, stream channel conditions, and stream cover types (USFS 1995). The analysis identified the Trout Creek watershed as the top priority for steelhead restoration due to the historic productivity and potential for recovery. In 1996 and 1997, the US Forest Service, US Fish and Wildlife Service and Underwood Conservation District began rehabilitation of the Trout Creek sub-watershed. These efforts have resulted in the development of bio-technical methods to improve steelhead habitat by stabilizing stream banks, improving channel complexity, reconnecting flood plains, and rebuilding riparian areas (Bair 1997). Adult fish passage problems at Hemlock Dam identified by Orsborn et al. (1987) were partially corrected in 1996 by increasing adult attraction flow at the ladder entrance and eliminating false attraction flow from the Wind River Nursery. Lethal maximum water temperatures and some fish passage impacts at this facility remain unresolved. Barber and Perkins (1999) indicated that the removal of Hemlock Dam is the preferred alternative to restoring anadromous salmonids in the Trout Creek basin and the USFS is currently evaluating the alternatives in the report. The USFS is updating the current Wind River watershed analysis and it should be completed in 2000.

In 1999, the Washington Conservation Commission completed a watershed assessment of salmon and steelhead habitat limiting factors in WRIA 29, which includes the Wind River (WCC 1999). Channel conditions, passage, water quality, and water quantity were evaluated and projects were ranked based on WCC criteria. Projects with the highest rankings included Hemlock Dam fish passage, riparian zone improvements in the upper Wind River and Trout Creek mainstem and tributaries, and increasing channel complexity in Trout Creek and tributaries. The purpose of the report is to provide a habitat impediment inventory that assists local citizen groups in developing functional habitat protection and restoration projects.

The WDFW, in cooperation with the USGS and USFS, are currently collecting biological, chemical and physical information in the Wind River watershed for incorporation into the Ecosystem Diagnosis and Treatment (EDT) analysis process developed by Mobrand et al. (1995). This analysis will be used to identify specific ecosystem components that limit the productivity, capacity, and life history diversity of the watershed. The analysis is designed to identify habitat limitations on a reach-by-reach basis, and the outcome of the EDT analysis should point to the most cost-effective methods to improve habitat conditions for each specific reach of the river. The EDT analysis is scheduled to be completed in 2000.

Limiting Factors

Fish

Stream surveys, sub-basin assessments, and watershed analyses were used to evaluate limiting factors in the Wind River. All watershed assessments indicate that fish production in the Wind River is primarily limited by habitat and water quality. Past riparian timber harvest, stream clean-outs, road building, and regeneration harvest within the rain on snow zone all have contributed to a decline in fish production. Alluvial reaches within the

mainstem Wind River and tributaries, which contain the majority of steelhead spawning habitat, have been significantly impacted. Many of these reaches were initially disturbed over eighty years ago, yet habitat and water quality have not recovered and in some cases are getting worse. Habitat problems noted in the subbasin plan are mainly related to timber harvesting practices. Throughout the subbasin there continues to be a need to restore riparian vegetation to reduce water temperatures and peak flows, reduce sediment delivery to streams, and ensure continuous recruitment of large woody debris into the system. Table 2 summarizes the fisheries synthesis of the 1996 Wind River Watershed Analysis that prioritizes restoration by sub-watershed for steelhead. Since other anadromous species are found primarily below Shipherd Falls, restoration activities in the lower Wind and Little Wind rivers would provide multi-species benefits.

Wildlife

For most species, there is a lack of essential historical data with which to adequately evaluate the impacts of Bonneville Pool inundation. For the Larch Mountain salamander, surveys are needed in areas where management may disturb potential habitats as well as surveys in the periphery of its known range to better define its distribution. For the fisher, it is unknown if there is adequate habitat in the southern Cascades to support a viable population should individuals successfully disperse from Oregon or if individuals are reintroduced from another population. In addition, information is lacking on how to effectively mitigate for the loss of riparian habitats and the connectivity they provide. Further information is needed to evaluate current loss of deer winter range from timber harvest and residential development.

Artificial Production

Carson National Fish Hatchery (CNFH) was constructed in 1938 to mitigate for the construction of Bonneville Dam and currently produces 1.4 million spring chinook smolts. This program was moved to RM 18 in 1956 after a fish ladder was constructed at Shipherd Falls to allow salmon access to the hatchery.

Hatchery summer steelhead smolts were released in the basin from the 1960's until 1998. These releases ranged from 20,000 - 100,000 during this time period. WDFW terminated the summer steelhead releases in 1997 due to genetic and ecological risks to a severely declining wild summer steelhead population. The USFWS Hatchery and Genetic Management Plans for spring chinook salmon is included in Appendix 1.

Table 2. Sub-watershed restoration risk factor analysis and prioritization, Wind River, Skamania County, Washington

Aquatic Impacts Index	H2O ID	Sub-Watershed	Project Area	Steelhead Biological "Hot Spots" Ranked	Potential Disease and Competition	High Risk of Increased Peakflows	High Risk of Sedimentation Impacts	High Risk of Increased Maximum Water Temperature	Extremely Poor Habitat Conditions (Riparian Veg, LWD, Pools, W/D)	Migration Barriers Subterranean Flows, Dams or Culverts
80	N	Lower Trout	Trout	4	X	X	X	X	X	X
78	J	Middle Wind	Middle Wind	1	X		X	X	X	
72	M	Layout	Trout	2	X	X	X	X	X	X
66	I	Upper Trout	Trout	3	X	X	X	X	X	
56	F	Dry	Middle Wind	6	X				X	X
54	H	Compass/Crater	Trout	5	X	X	X	X	X	X
42	V	Upper Wind	Upper Wind	7	X	X	X		X	
24	T	Lower Panther	Panther	8	X		X		X	X
15	D	Trapper	Middle Wind	9	X					
12	Z	Lower Wind	Lower Wind	11	X		X			
6	B	Headwaters Wind	Upper Wind			X	X	X	X	X
5	C	Lower Falls	Upper Wind	15	X	X	X	X		
4	W	Pete's	Upper Wind		X			X	X	
4	U	Little Wind	Lower Wind	10						
3	G	Nine-mile	Middle Wind	13	X	X				
3	A	Paradise	Upper Wind	12	X					
3	L	Upper Panther	Panther		X	X	X			
3	K	Eight-mile	Panther	8	X	X				
3	O	Lower Bear	Panther		X	X				
2	R	Mouse	Panther	8			X			
2	S	Cedar	Panther	14						
1	P	Upper Falls	Upper Wind		X					
1	Q	NF Bear	Panther		X					
1	X	EF Bear	Panther		X					
1	Y	Brush	Lower Wind			X				
0	E	Big Hollow	Middle Wind							

X = High Risk of Negatively Impacting Steelhead Productivity

Existing and Past Efforts

Coordination

One major obstacle to the recovery of fish and wildlife populations is the lack of a local coordinated effort. Major accomplishments have been recently made in this area on the Wind River (Table 3). The Wind River Restoration Team (WRRT) was formed in 1994 in response to the decline of wild steelhead within the Wind River. The team includes technical specialists from the USFWS, WDFW, USGS, Washington Trout (WT) and the Yakama Indian Nation (YIN). In 1997 this group was restructured into a TAC to support the activity of the Wind River Watershed Council. The mission statement for the council is "A partnership which encourages the use of land management practices which sustain and improve water quality, fish habitat, and other natural resources while contributing to long-term economic and community sustainability within the Wind River watershed".

Table 3. Wind River Subbasin coordination accomplishments

Year	Accomplishment
1994	Created Wind River Restoration Team, which became the Technical Advisory Committee (TAC) to the Wind River Watershed Council when formed in 1997.
1997	Created Wind River Action Committee (now named the Wind River Watershed Council [WRWC]) and it's Technical Advisory Committee (TAC)
1997	Coordinated monthly meetings of WRWC that included stakeholder presentations and participation.
1997	Developed a mission statement and goals within the WRWC
1997	Coordinated monthly meetings of TAC.
1998	Coordinated monthly meetings of WRWC that included stakeholder presentations and participation.
1998	Developed process for prioritizing restoration projects and implemented it within the WRWC.
1998	Coordinated monthly meetings of TAC.
1998	Expanded WRWC to incorporate a larger stakeholder representation.
1999	Reviewed 5 restoration and education projects submitted by WRWC and TAC.

Monitoring and Evaluation

A coordinated monitoring effort is being conducted for fish populations, fish habitat, and water quality (Table 4). WDFW has developed adult chinook salmon abundance estimates since 1964, wild adult steelhead abundance estimates since 1985, and wild smolt population estimates since 1995. Adult abundance data consists of redd, carcass, and live fish counts. In 1999, WDFW redesigned its adult steelhead monitoring program to develop population estimates with confidence limits using a mark-recapture experimental design. The smolt monitoring program consists of wild steelhead and salmon population estimates with confidence intervals for the entire subbasin and for key production zones in Trout Creek, Panther Creek, and the Upper Wind River. From 1996 to the present ,USGS-CRRL has developed age 0, and age 1+ population estimates from key production zones in Trout Creek, Panther Creek, and the Upper Wind River.

Table 4. Wind River Subbasin monitoring and evaluation accomplishments

1998-2000	Measured fine sediment composition in nine subbasins.
1997-2000	Conducted stream survey; in 9 streams, ~20,600 m per year
1996-2000	Assessed density of juvenile steelhead and other fish species in 7 streams by electrofishing covering ~3.1 km per year
1994-2000	Monitored adult steelhead at Trout Creek trap site for 12 months
1999-2000	Restored and modified adult fish trap at Shipherd Falls
1997-2000	Monitored stream temperature at 14 sites for 12 months with continuous temperature loggers (USGS)
1999	Monitored stream temperature at 26 sites with continuous temperature loggers to establish TMDL for Wind River
1995-2000	Operated smolt traps and determined salmon and steelhead smolt production
1985-2000	Monitored adult steelhead escapement with redd surveys

1988-2000	Monitored adult steelhead escapement with snorkel counts
1997-2000	Monitored stream discharge during June-October in 9 tributary streams
1997-1999	Monitored stream discharge in Lower Wind River and Trout Creek
1964-2000	Monitored fall chinook salmon abundance below Shipherd Falls

The USFS and USGS-CRRL have conducted habitat surveys primarily in the upper Wind River, Trout Creek, Panther Creek, and their tributaries. Data includes flow, channel morphology, Large woody debris (LWD), embededness, fine sediment, quality and quantity of pools, riffles, and other fish habitat units. The USFS, DOE, USGS, and UCD have also monitored water quality including turbidity, temperature, and conducted chemical analysis. DOE has completed a TMDL for water temperature in the Wind River. This monitoring and evaluation program is designed to evaluate restoration measures that modify habitat and water quality to determine their impact on wild steelhead production and survival.

Assessment

A series of assessments have been made in the Wind River Watershed based on data collected from the monitoring and evaluation program (Table 5). These assessments are based on the adaptive management principles and are periodically updated. The fisheries agencies and tribes developed a subbasin plan in an effort to increase runs of anadromous fish in the early 1990s. Since then, the USFS has conducted three watershed analyses and a study of the impacts of Hemlock Dam on anadromous fish passage. The major emphasis of these analyses has been to define current and desired future conditions for fish and wildlife habitat, and to develop management and future restoration activities consistent with these goals. In 1999, the Washington Conservation Commission completed a limiting factors analysis, which identified degraded anadromous fish habitat in the subbasin and recommended restoration projects. Many of the recommended habitat projects from these analyses have been completed and are listed in the Restoration section. In 2000, WDFW, with the USFS and USGS, has applied the Ecosystem, Diagnosis and Treatment (EDT) model, which will link historic and current habitat conditions to fish populations for steelhead, chum, and chinook salmon. The intent of this assessment is to better define the expected outcome of restoration or recovery projects on wild fish populations with the Wind River subbasin.

Table 5. Wind River Subbasin assessment accomplishments

1990	Wind River Subbasin Plan
1992	Trout Creek Watershed Assessment completed
1996	Wind River Watershed Analysis completed
1999	Limiting Factors Analysis completed
1999	Hemlock Dam Fish Passage Assessment
2000	Wind River Watershed Assessment updated
2000	Ecosystem Diagnosis and Treatment being applied to Wind River using steelhead, chinook, and chum salmon as indicator species

Restoration

Based on the outcome of the assessments mentioned above, the USFS, USFWS, UCD and other partners have made significant progress in restoring hydraulic processes and rehabilitation of critical habitat since 1992. From that time, approximately 75 miles of road have been stabilized or "storm-proofed", 35 miles have been decommissioned, 120 acres of flood plain have been reclaimed, 300 riparian acres have been planted, and 2,000 pieces of large woody debris have been placed back in 6 river miles of stream. Table 6 provides a detailed list of restoration projects completed in the Wind River watershed (1991-1998).

Table 6. Watershed restoration summary for completed projects within the Wind River, Skamania County, Washington

Award year	Location (watershed)	Project title	Activity type	Miles complete	Total funded	Project planning	Impl.	Funding source
91	M/L Wind	Little Soda Springs	Channel Work	0.4	35,306	17,950	17,356	P & M
92	Trout	Trout Creek Riparian Rehab	Riparian Planting	2.3	8,954	1,708	7,246	P & M
93	M/L Wind	Little Soda Springs	Channel Work	0.4	15,338	6,050	9,288	P & M
93	Trout	Layout Cr Riparian Rehab	Riparian Planting	1.6	6,379	945	5,434	P & M
94	Trout	Trout/Layout Soil Bio-Engr	Bank Stabilization	1.2	55,281	7,624	47,657	USFWS, USFS & UCD
94	Trout	Trout/Compass/Crater	Riparian Planting	2.5	19,114	2,660	16,454	USFWS & USFS
94	U Wind	Mining Reach	Riparian Planting	3.1	20,220	1,660	18,560	USFWS & USFS
95	Wind	Decomissioning in Key (95.11.03)	Decommissioning	4.3	41,400	6,900	34,500	JITW
96	Trout	Trout Creek Instream Phase 1 and 3	Channel Work	3	119,800	23,800	96,000	JITW, USFWS & UCD
96	Trout	Upper Trout Ck Roads	Decommissioning	5	48,000	8,000	40,000	JITW
96	Up Wind	Rd 3100106 Decomissioning	Decommissioning	4.8	46,500	7,750	38,750	JITW
96	Wind	Mid Wind, Nine Mi., Eight Mi Rds	Decommissioning	5	48,000	8,000	40,000	JITW
96	Trout	Trout Creek Fish Ladder	Fish Passage Improvement	0	90,000	15,000	75,000	JITW
96	Trout	Riparian Restoration (96.09.08)	Riparian Planting	0	27,000	4,500	22,500	JITW
96	Wind	Wind River Rd Stormproffing	Stabilization	5	48,000	8,000	40,000	JITW
97	Panther	H94 Panther Cr. Bank Stab	Bank Stabilization	0	1,320	396	924	Flood
97	Dry/Falls	Falls & Dry Cr. Trail Bridges	Bridge Repair	0	19,050	2,800	16,250	JITW
97	M Wind	PCT Trail Bridge	Bridge Repair	0	28,800	4,800	24,000	JITW
97	Panther	Panther Cr. Dispersed Site Rehab	Camp Site Rehab	0	25,000	4,500	20,500	JITW
97	Trout	Layout Cr Structure Renovation	Channel Work	0.1	14,160	2,000	12,160	JITW
97	Up Wind	Hatchery Reach	Channel Work	1.6	67,000	11,900	55,100	JITW & USFWS
97	Panther	Panther Cr. Rd Decomm.	Decommissioning	15	132,000	5,500	126,500	JITW
97	Trout	Road 4101 Oblit	Decommissioning	4.6	43,560	6,534	37,026	Flood
97	Trout	Road 4101402 Oblit	Decommissi	0.2	1,450	218	1,233	Flood

Award year	Location (watershed)	Project title	Activity type	Miles complete	Total funded	Project planning	Impl.	Funding source
			oning					
97	Up Wind	Black Cr. Swamp Rd Decom	Decommissioning	2.9	24,000	1,000	23,000	JITW
97	L Wind	Road 68 Bear Cr. Slide, MP 16.2 Reveg	Erosion Control	0.375	3,750	750	3,000	JITW
97	M/L Wind	J3 Tyee Springs	Erosion Control	0	3,960	1,188	2,772	Flood
97	M/L Wind	Landslide Stab (9 slides)	Erosion Control	0	3,960	1,188	2,772	Flood
97	Panther	H7 Road 6063090 Reveg	Erosion Control	0.06	740	222	518	Flood
97	Trout	Road 5400 (mp 8.1)	Erosion Control	0.06	660	198	462	Flood
97	Trout	Road 5400 ID #8540	Erosion Control	0.11	1,310	393	917	Flood
97	Up Wind	H10 Road 3056 Reveg	Erosion Control	0.05	530	159	371	Flood
97	Up Wind	Road 6401 Reveg	Erosion Control	0.05	530	159	371	Flood
97	Trout	Trout Ck. Fish Ladder Aux. Flow	Fish Passage Improvement	0.02	40,500	3,500	37,000	JITW
97	M/L Wind	G1 9-Mile Cr Slide Rest	Riparian Planting	0	10,877	756	10,121	Flood
97	M/L Wind	G2 9-Mile Cr. Slide Rest	Riparian Planting	0	8,200	2,460	5,740	Flood
97	M/L Wind	Mouse Cr. Stabilization	Slide Restoration	0	1,644	744	900	JITW
97	Panther	Panther Cr. Slide Stabilization	Slide Restoration	0	1,400	200	1,200	JITW
97	Trout	Compass Cr Slide Rehab	Slide Restoration	0	30,000	4,000	26,000	JITW
97	M/L Wind	GMS Road Repair	Stabilization	2.7	25,080	3,762	21,318	Flood
97	M Wind	Trail Damage Repair (Dry & Big Hollow)	Trail Repair	0	3,550	700	2,850	JITW
97	Wind	SSC Noxious Weed Control	Weed Control	0	24,000	1,500	22,500	JITW
98	M/L Wind	J4 PCT Bridge Protection	Channel Work	0.3	9,925	2,182	7,743	Flood
98	Panther	Q2 Panther Cr Channel Repair	Channel Work	0.2	7,770	2,331	5,439	Flood
98	Trout	I3 Trout/Compass confluence	Channel Work	1.58	7,920	2,376	5,544	Flood
98	Panther	K4 Panther Cr. Trib Slide Resto	Riparian Planting	0	8,955	723	8,232	Flood
98	Panther	K2 Eightmile Cr Planting	Riparian Planting	0	8,270	2,481	5,789	Flood
98	Panther	K3 Eightmile Cr Bank Prot	Slide Restoration	0	9,539	774	8,765	Flood
98	Up Wind	A1 Paradise Slide #1	Slide Restoration	0	10,560	3,168	7,392	Flood
98	Up Wind	A2 Paradise Slide #2	Slide Restoration	0	530	159	371	Flood
98	M/L Wind	General Storm Proofing	Stabilization	6.6	62,440	9,366	53,074	Flood
		Traveling Screen/ Enclosure Mod	Fish Passage Improvement	0	2,500		2,500	JITW
98	Dry	Dry Cr Roads, 65202-3	Decommissioning	4.4	109,000	21,800	87,200	BPA & JITW
					1,274,732	205,634	1,069,099	

Outreach/Education

The successful restoration of the Wind River Subbasin will not take place without local participation in the process. The UCD has taken on the primary leadership role in this area. Over the last few years a series of concentrated outreach efforts have been made in the community through a variety of activities including: 1) presentations to the local watershed council, 2) development of educational material for the public including signing of the watershed, 3) presentations and field trips with students in Stevenson School District and development of environmental curriculum so they better understand the watershed, 4) providing technical assistance to landowners for restoration projects that are consistent with watershed assessments, and 5) initiating trash clean up projects (Table 7).

Table 7. Wind River Subbasin outreach and education accomplishments

1998-2000	Made salmon and environmental presentations at the high school, middle school, and elementary school and hosted high and middle school monitoring program.
1998-2000	Promoted community awareness of watershed issues by developing displays at the Skamania Lodge and Skamania county fair, developing a watershed logo contest, and developing educational brochures.
1999	Placed watershed awareness signs through out the watershed.
1998	Hosted watershed trash clean up and tree planting.
1999-2000	Provided technical assistance to local landowners to formulate watershed restoration projects
1999-2000	Made public and professional society presentations regarding fish and environmental issues on the Wind River
1999	Published a report on Wind River Watershed Project (Connelly 1999)

Subbasin Management

Goals, Objectives, and Strategies

Participants in this planning process identified goals, objectives, and strategies for the subbasin. The objectives may not be quantifiable or include a time period. This is due in part to the watershed assessment's not being finalized, and the lack of consensus on the desired future condition of fish and wildlife populations and their habitat. In addition, recent data from the Wind River and other Columbia River tributaries indicates that salmon and steelhead populations have experienced wide swings in abundance making it difficult to establish meaningful quantifiable objectives without taking into account natural environmental variability. The participants hope to use the assessments and other data to fully develop these objectives, strategies, and actions in the coming years. Listed below is the general goal agreed upon by all participants as well as individual agency/tribal goals.

Cornerstone Goal (all participants)

Restore wildlife and fish populations and habitat to levels that support ecosystem benefits and harvest, sustain and/or restore water quality, and maintain long-term economic and community sustainability.

Goals

Yakama Tribe

1. Restore/reclaim anadromous fishes to the rivers and streams that support the historic cultural and economic practices of the tribes for future generations.
2. Protect tribal sovereignty and treaty rights.

State of Washington (Washington's Statewide Salmon Strategy)

Restore salmon, steelhead, and trout populations to healthy harvestable levels and improve the habitat on which fish rely on.

Washington Department of Fish and Wildlife

1. Sound stewardship of fish and wildlife (mission statement)
2. Protect, restore, and enhance the productivity, production, and diversity of wild salmonids and their ecosystems to sustain ceremonial, subsistence, commercial, and recreational fisheries; non-consumptive fish benefits; and other related cultural and ecological values (Wild Salmonid Policy).

Washington Department of Ecology (Water Quality Program)

To protect, preserve, and enhance Washington surface and ground water quality, and to promote the wise management of our water for the benefit of current and future generations.

Wind River Watershed Council

Develop partnerships which encourage the use of land management which sustains and improves water quality, fish habitat, and other natural resources, while contributing to long-term economic and community sustainability within the Wind River watershed.

Columbia River Inter-Tribal Fisheries Enforcement

Protect, enhance and restore wild and natural anadromous and resident fish populations within this watershed of the Columbia Gorge Province.

Objectives

Wind River Restoration Team (1995)

Rebuild wild summer steelhead populations in the Wind River to 500 spawners while preserving genetic diversity to lessen extinction risks.

Washington Department of Ecology (in conjunction with Skamania County and WDFW)

Develop a plan within 4 years that will address water quantity, water quality, habitat and instream flow.

Columbia River Inter-Tribal Fisheries Enforcement

Maintain natural populations of anadromous and resident salmonids at levels that promote increased utilization of available habitat and that contribute to tribal and non-tribal fisheries as measured by an increasing trend in population abundance and distribution by the year 2012.

Strategies

Wind River Restoration Team (1995)

1. Coordinate watershed stakeholders in order to guide the implementation of watershed restoration actions that are consistent with stakeholder objectives;
2. Monitor physical habitat conditions and natural production of juvenile, smolt, and adult steelhead in the Wind River subbasin;
3. Use a science based framework to assess the condition of the watershed to determine what factors prevent stakeholder objectives from being met and to prioritize actions that result in meeting those objectives;
4. Restore stream habitats and watershed processes that will support self-sustaining populations of steelhead;
5. Promote watershed stewardship among students, the community, private landowners, and local governments;

Yakama Tribe

1. Improve adult pre-spawning survival;
2. Improve juvenile rearing survival;
3. Improve adult and juvenile passage survival

US Forest Service

1. Reduce water temperatures in Trout Creek and the upper Wind River.
2. Restore riparian area
3. Reduce road densities
4. Increase the quality of pools through recruitment of large woody debris.

Specific action items on the restoration of native anadromous fishes through habitat restoration are listed in Tables 8 and 9 in the next section. These are the outcome of watershed assessments and limiting factors analysis. There may not be consensus on the priority of these actions but there is agreement that they would improve anadromous fish habitat. Differences still exist on the use of hatchery salmon and steelhead within the basin. Specific action items for hatchery production can be found in the Carson National Fish Hatchery HGMP (see Appendix), Tribal Fish Restoration Plan, Lower Columbia Steelhead Conservation Initiative, and WDFW's Wild Salmonid Policy.

Columbia River Inter-Tribal Fisheries Enforcement

1. Integrate conservation law enforcement protection into fish, wildlife and habitat management.

2. Identify and enforce laws and rules pertaining to fish passage, riparian habitat, and water quality protection. Provide information on enforcement actions to the system-wide conservation enforcement monitoring and evaluation project.
3. Identify and enforce laws and rules pertaining to exotic fish transfers.
4. Identify violations of laws and rules pertaining to habitat protection and provide information to appropriate state, federal or tribal law enforcement entity.
5. Increase enforcement of laws and fishing regulations pertaining to illegal take of fish (all life stages).
6. Continue enforcement of wildlife laws and regulations affecting wildlife species and habitat.

Research, Monitoring, and Evaluation Activities

We have applied an adaptive management approach to achieving our goals for the Wind River watershed. Objectives and strategies to reach goals are developed annually. Monitoring and evaluation of strategies occurs annually. Based on these results, our objectives and strategies are reviewed annually and may be modified based on the results of the monitoring and evaluation program.

After completion of the USFS watershed analysis and WDFW ecosystem diagnosis and treatment assessments for the Wind River, a finalized comprehensive watershed or subbasin plan needs to be developed by those responsible for management of the watershed and its fish and wildlife resources. In the interim, habitat and fish populations should be monitored to determine fish responses toward recovery actions and the status of fish populations assessed. Finally, habitat projects identified in Tables 8 and 9 should be reviewed based on the current assessment and modified if needed.

Table 8. Site problem ranking for the Wind River from the Limiting Factors Analysis completed by the Washington Conservation Commission in 1999. Cost estimates are based on similar restoration projects completed in 1997-1999.

Site problem (highest priority first)	Ranking Score	Estimated Cost
1. Hemlock Dam	71.0	$ 1,600,000
2. Trout Creek Riparian	28.1	9,000
3. Trout Creek Channel Downcutting	27.1	73,000
4. Trout Creek LWD Removal	27.1	22,500
5. Middle Wind Floodplain	27.0	109,400
6. Layout Creek Riparian Zone	26.8	16,500
7. Compass Creek Riparian Zone	26.2	8,000
8. Upper Wind Riparian	26.0	9,500
9. Crater Creek Riparian Zone	25.3	12,000
10. Middle Wind Riparian	25.0	20,000
11. Middle Wind LWD	25.0	89,000
12. Layout Creek LWD Removal	24.8	18,500
13. Layout Creek Channel Downcutting	24.8	47,700
14. Compass Creek LWD Removal	23.2	18,000
15. Crater Creek LWD Removal	23.0	12,000
16. Dry Creek Riparian Zone	22.4	16,400
17. Dry Creek LWD Removal	21.4	11,000
18. Compass Cr. Channel Downcutting	21.2	73,000
19. Crater Creek Channel Downcutting	21.0	62,100
20. Paradise Creek Mass Wasting	21.0	13,800
21. Upper Wind Diking/Road	20.0	96,300
22. Youngman Creek Riparian Zone	18.7	9,400
23. Middle Wind Water Diversion	18.5	114,000
24. Oldman Creek Riparian Zone	17.1	6,000
25. Trapper Creek Channelization	17.0	151,000
26. Trapper Creek Floodplain Filling	17.0	94,000
27. Trapper Creek Channel Constriction	17.0	148,000
28. Tyee Creek Diversion	17.0	68,000
29. Lower Wind Mass Wasting	16.5	10,000
30. Little Wind Mass Wasting	15.5	7,500
31. Trapper Creek Diking	15.0	65,500
32. Trapper Creek Channel Downcutting	14.0	104,000
33. Oldman Creek Culvert #1	14.0	16,500
34. Wind Mouth Sediment	13.5	350,000
35. Oldman Creek Culvert #2	12.3	22,000
36. Youngman Creek Culvert	11.8	18,000
37. Oldman Creek Culvert #3	11.0	23,700
Total (excludes Hemlock Dam #1)		$ 1,945,300

Table 9. USFS Outyear riparian and channel restoration project priorities and cost estimates for the Wind River Watershed, Skamania County, Washington

Pri-ority	Stream Segment or Reach	River Miles	Limiting Factors							Cost Est.	Status
			Riparian	Pools	LWD	W/D	Banks	Flood Plain	Migration		
1	Hemlock Dam	0.1							X	$375,000	Planning
2	Trout 5	2.2	X		X		X	X		$114,400	Complete
3	Layout 1	1.1	X	X	X	X	X	X		$106,700	Complete
4	Trout 4	1.8	X		X					$93,600	Planned
5	Upper Wind 3	0.9	X	X		X	X			$46,800	Planned
5	Upper Wind 4	0.6	X	X		X	X			$31,200	Planned
										$78,000	
6a	Middle Wind 3	1.6	X		X		X			$150,400	Planned
6b	Middle Wind 2	1.5			X			X		$67,500	Complete
6c	Middle Wind 1	2.2			X			X		$99,000	Planned
										$316,900	
7	Layout 2	0.6	X	X	X	X				$57,000	Surveyed
8	Trout 6	1.9	X		X		X	X		$98,800	Surveyed
8	Trout 7	0.7	X				X			$36,400	Surveyed
										$135,200	
9a	Dry 3	0.6	X		X			X		$56,400	Planning
9b	Dry 1	1.8	X	X	X	X	X			$172,800	Planning
										$229,200	
10a	Crater 1	0.3	X	X	X	X				$28,500	Surveyed
10b	Crater 2	0.2	X			X	X			$18,800	Surveyed
10c	Crater 3	0.3	X		X	X				$28,200	Surveyed
										$75,500	
11a	Compass 1	0.4	X	X	X	X				$38,000	Surveyed
11b	Compass 2	0.9		X	X					$41,400	Surveyed
11c	Compass 3	1.2		X	X					$55,200	Surveyed
11d	Compass 5	1							X	$20,000	Surveyed
										$154,600	
12a	Crater 6	0.4			X				X	$38,000	Surveyed
12b	Crater 4	0.3	X			X	X			$28,200	Surveyed
12c	Crater 5	0.4			X					$18,000	Surveyed
										$84,200	
13	Trapper 1	1.9			X					$109,250	Surveyed
14a	Oldman 1	1.1	X		X				X	$103,400	Surveyed
14b	Youngman 1	0.9		X		X	X		X	$51,750	Surveyed
14c	Oldman 2	0.5	X	X	X	X			X	$47,000	Surveyed
14d	Oldman 3	0.5		X	X	X			X	$23,000	Surveyed
										$225,150	
15a	Planting 1	0.4			X					$18,400	Surveyed
15b	Planting 2	0.5			X					$23,000	Surveyed
										$41,400	
16a	Pete's Gulch 2	0.9	X		X					$4,680	Surveyed
16b	Pete's Gulch 1	0.8	X		X					$4,160	Surveyed

Pri-ority	Stream Segment or Reach	River Miles	Limiting Factors							Cost Est.	Status
			Riparian	Pools	LWD	W/D	Banks	Flood Plain	Migration		
										$8,840	
17a	Trout 3	0.4	X							$800	Surveyed
17b	Eightmile 1	0.8	X							$2,000	Planned
										$2,800	
18	Proverbial 1	1.5	X		X					$9,750	Surveyed
26	Panther 2	1.1	X							$2,200	Surveyed
30	Panther 4	0.6			X					$27,600	Surveyed
31	Panther 5	0.8			X					$36,800	Surveyed
	Total	35.7								$2,284,090	

Fish and Wildlife Needs

- Determine abundance, distribution, survival by life-stage, and status of fish and wildlife native to the watershed including steelhead, coastal cutthroat, fall chinook, bull trout, coho salmon, lamprey, crawfish, and others.
  Rationale: Wind River steelhead and chinook salmon are part of the Lower Columbia River ESU and are currently listed under the ESA. Abundance and survival estimates will be needed to determine if habitat restoration programs are working and to determine if these fish can be removed from the Endangered Species list. Bull trout in the Columbia River are currently listed under the ESA. Bull trout have been observed in the lower Wind River and habitat in the headwaters of Wind River tributaries are suitable for these fish. Determining the status, abundance, and potential areas for Bull Trout reintroduction are all needed to recover Columbia River bull trout. Coastal cutthroat trout have been proposed for listing under ESA and coho salmon are considered a candidate for listing under ESA because of possible lowered status across their distributional range. Little is known about historical and current distribution and status of these fish in this watershed. Abundance of pacific lamprey has declined above Bonneville Dam. In addition, recent observations during fish sampling efforts and comparison of these observations with historical observations suggest crayfish have disappeared from some of their former range. Crayfish and lamprey are likely an important part of the food chain, and documenting their distribution and status is an important factor for assessment of health of the Wind River ecosystem.

- Determine genetic and life history types of native fish and wildlife and the strength of their current expression relative to historical and desired future conditions.
  Rationale: Maintaining life history and genetic diversity allow fish to be productive under the current and a wide variety of future conditions. Determining these levels of diversity will help develop successful recovery strategies.

- Assess effect of natural escapement of hatchery spring chinook and brook trout on natural production of steelhead.
  Rationale: Spring chinook salmon and brook trout are not native to the Wind River. Recent record high escapements of spring chinook and areas of high brook trout

abundance may present an ecological risks to native ESA listed steelhead. These interactions should be evaluated to determine if negative interactions keep the wild steelhead population from rebounding.

- Determine if high infestations of the ciliated protozoan *Hydropolaria lwoffi* (formerly *Epistylis lwoffi*) lowers survival of juvenile steelhead and determine if degree and distribution of infestations in juvenile steelhead is related to water quality, habitat conditions, or other environmental stressors.
  Rationale: The current strategy for the recovery of wild steelhead is through increases in natural production. This strategy may not be possible if this disease prevents ESA listed wild steelhead from recovering through a reduction in survival.

- Determine the effectiveness of habitat restoration projects on achieving the desired physical change and measure the response of wild steelhead populations to these changes.
  Rationale: The USFS, USFWS, and BPA have spent hundreds of thousands of dollars on habitat restoration in the Wind River and requests have been made to continue this effort. Large-scale monitoring and site-specific monitoring projects are needed to evaluate the effectiveness of these actions.

- Assess effect of operations of Bonneville and The Dalles dams on the fish and wildlife production capacity and migration corridor of the portion of Wind River that is inundated with the impounded waters.
  Rationale: The inundation of the Bonneville Pool has permanently flooded and seasonally floods sections of the lower Wind River. Fish production and wildlife may be negatively impacted by large-scale ecosystem changes including sedimentation, water temperature, turbidity, and predator access.

- Implement restoration actions identified in the watershed assessments that are consistent with recovery of fish and wildlife populations and their habitat.
  Rationale: Restoration projects that are the outcome of watershed assessments and have gone through a review process have addressed factors that limit the recovery of fish and wildlife populations. These projects should have a high probability for success. The above or modified monitoring and evaluation programs should be funded as part of these restoration activities.

- Continue watershed coordination and local stewardship programs.
  Rationale: The land and resource management decision needed to recover fish and wildlife populations and their habitat will impact local residents. Many of these people are knowledgeable about these resources and should be part of the decision process. Their involvement is very important to the outcome of management decisions and address local concerns about long-term community and economic sustainability.

- Preservation of viable fish & wildlife populations through improved habitat protection, habitat enhancement and law enforcement

Enhanced fish, wildlife & habitat law enforcement was conducted throughout the Columbia Basin by federal, state and tribal entities during 1991-1998. Beginning in May 2000, the Columbia River Fisheries Enforcement Department is implementing increased conservation enforcement efforts in the mainstem Columbia, and its tributaries -- in cooperation with adjoining jurisdictions.

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